Winter 2-1953

Volume 64 - Issue 5 - February, 1953

Rose Technic Staff
Rose-Hulman Institute of Technology

RoseTechnic

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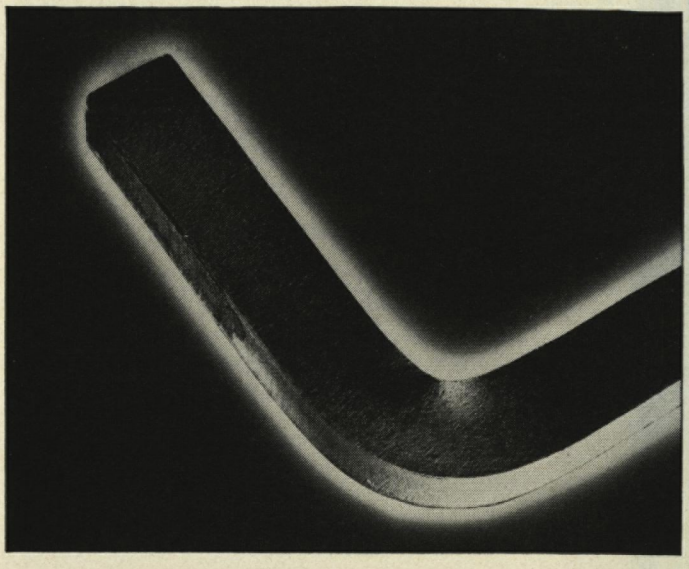
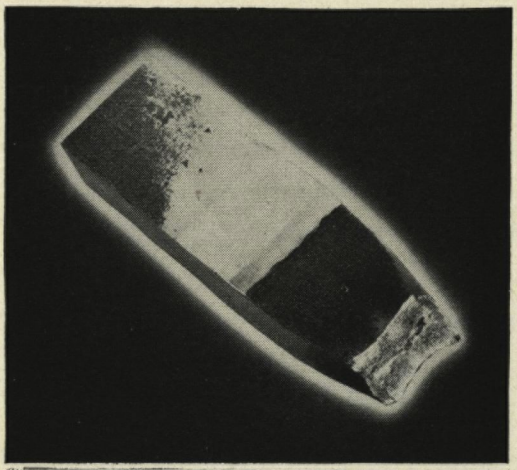
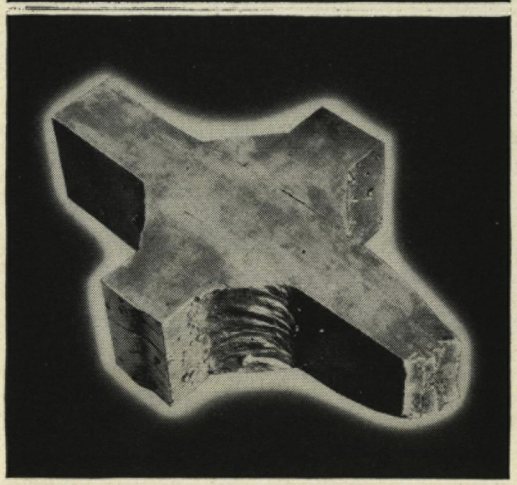
February 1953

90° BEND AT 98 BELOW! This sample, flame-cut from 1" CARILLOY T-1 plate, was chilled to −98°F., and then bent to a full 90° angle. Even though the raw, flame-cut edge made up the outer radius of the bend, there was no sign of failure!



New steel has yield strength of over 90,000 psi yet remains ductile at 70°F. below zero even after welding or flame-cutting





100% WELD STRENGTH—Tensile tests on T-Steel specimens like these were made to determine the strength of the welds. These welds develop the full strength of the parent metal. Note that breaks occur outside the heat-affected zone, showing that the heat of welding has not harmed the strength of the material. No special pre-heating or post-heating treatments are required beyond those used with ordinary structural steels.

THIS remarkable steel, U·S·S CARILLOY T-1, offers great promise to those who need a super-strong steel that can be welded, flame-cut or cold-formed.

CARILLOY T-1 is unique. It differs from all other very strong steels in important respects: Its yield strength of over 90,000 psi is *not* lowered by welding or flame-cutting. In these operations, no pre-heating or stress-relieving is required. As a result. CARILLOY T-1 can be readily field welded.

Usually, welded steels of such high strength level suffer a loss of ductility at low temperatures unless elaborate precautions are taken in the welding operation. In striking contrast, notched bend weldability tests show that T-1 steel will remain ductile and tough down to the lowest atmospheric temperatures. As a matter of fact, T-1 steel, after flame-cutting, has been bent to a full 90° angle at temperatures as low as −100°F., without any sign of cracking.

Service tests show that CARILLOY T-1 is well suited for extremely abusive service, and the fact that it can be field welded should greatly lower the difficulties and cost of major repairs. In applications in which tension is the principal stress, thicknesses can often be reduced to one-third of those required with ordinary structural steels.

CARILLOY T-1 steel is another result of United States Steel's active research program which has enabled manufacturers to improve their production methods and make better products, too. All over the country, trained U. S. Steel engineers and metallurgists are constantly at work on problems like this, finding better ways to make and use steel. United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

USS

UNITED STATES STEEL

Rose Technic

VOLUME LXIV, NO. 5 FEBRUARY, 1953

In This Issue

The Cover

One of a fleet of International TD-24 diesel crawler tractors working on relocation of railroad right of way back of McNary Dam near Pasco, Washington. The reservoir which will form behind the new dam will cover the old roadbed of the Spokane, Portland, and Seattle Railroad. The big tractors are moving mountains of talus rock which will be used for fill on the new right of way. Courtesy of INTERNATIONAL HARVESTER.

The Frontispiece

The 5000 hp two-shaft, regenerative cycle, gas turbine shown is being assembled for the El Paso Natural Gas Company. The new gas turbines are now being used successfully to pump natural gas through pipelines. Courtesy of GENERAL ELECTRIC.

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Rose Technic

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You can elect an electronic future at GM

The engineers in the picture are using a very simple looking little instrument called the Surfa-Gage.

Yet it is one of the most important contributions of the electronic age to quantity production of quality products.

For the Surfa-Gage allows production engineers to measure the surface of a part to determine the part's conformance to specified smoothness—within micro-inches — and thus insure greater wearing qualities.

We mention the Surfa-Gage here as just one example of the continuous General Motors developments in the field of electronics — from new airplane bombsights and tank range finders to improved car ignition systems, radios and controls for many manufacturing processes.

For we want the soon-to-be-graduated electrical engineer to know that he will find as wide a latitude for his training at GM as will the mechanical or metallurgical engineering student.

After all, the development of modern GM products—of all kinds—requires the development of tools to build those products. And this means a tremendous amount of work in electrical engineering—from the research lab to the production line.

So to the electrical engineer as to engineers in the other categories listed at right—we say there may well be a job with an interesting future for you at GM. Why not ask your College Placement Office to arrange a meeting for you with the GM College Representative the next time he visits your campus. Or drop us a line.

GM POSITIONS NOW AVAILABLE IN THESE FIELDS:

Mechanical Engineering
Electrical Engineering
Metallurgical Engineering
Industrial Engineering
Chemical Engineering

GENERAL MOTORS

Personnel Staff
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HIGH SCHOOL GRADUATES OF 1953

You are cordially invited to visit Rose Polytechnic Institute during the present school year to learn more about your college entrance and the engineering courses available to you at Rose. The next freshman class will be admitted September 8, 1953.

NOBLE C. BLAIR

Admissions Counselor

ROSE POLYTECHNIC INSTITUTE

TERRE HAUTE, INDIANA

5 paths to your success at DETROIT EDISON

• Engineering Planning, Design and Construction

The development and economic utilization of progressive engineering methods to make possible the continued expansion of industry and modern living.

• Power System Engineering

The application of proved engineering principles to the day-to-day problems of operating the equipment used in the production, transmission and distribution of electric power.

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The promotion of increased sales by helping the consumer make the best use of the energy he buys, and by showing him how to let electricity do more of his jobs.

• Research

The investigation of problems which daily face any part of the production, distribution or sale of electricity, and making recommendations for their solution.

• Business Management

The coordination of problems related to Company finance, materials, property and personnel for the efficient operation of the business.

These are the five principal channels through which graduates may advance at The Detroit Edison Company. Under these broad headings are hundreds of different positions—all working together for the best interests of customer, employe, and investor.

When a graduate joins The Detroit Edison Company, he is assured every opportunity to fit into the job he likes best—and, once there, he knows he will be encouraged to advance as rapidly as his ability and energy will carry him.

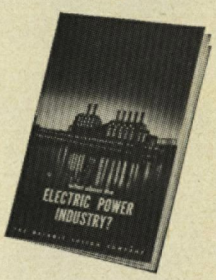
Detroit Edison is a fast-growing electric utility company. It is foresighted, too. For example, already Detroit Edison engineers are working with Dow Chemical Company as one of the nation's four atomic research teams. Under investigation is use of nuclear heat in thermal electric generating plants, to produce electric power even more efficiently.

There's a future for graduates at The Detroit Edison Company—a career opportunity best described by the fact that many of the high ranking executives in the organization at this time began their climb to success in positions similar to those offered graduates today.

ANOTHER DETROIT EDISON STORY OF CAREER SUCCESS

Paul Murphy, Jr., received his BSME degree from Purdue in 1941. After four years of service as a Naval engineering officer, he joined Detroit Edison as a junior engineer in the Production Department and progressed in less than seven years to the position of Boiler Room Engineer in charge of all 12 boilers at Detroit Edison's Delray plant, a position of responsibility that includes the supervision of methods, procedures, and maintenance scheduling for boilers and coal handling equipment.

For the full story of your career opportunities at Detroit Edison, simply call or write for a free copy of this new booklet "What about the Electric Power Industry?"



The DETROIT EDISON Company

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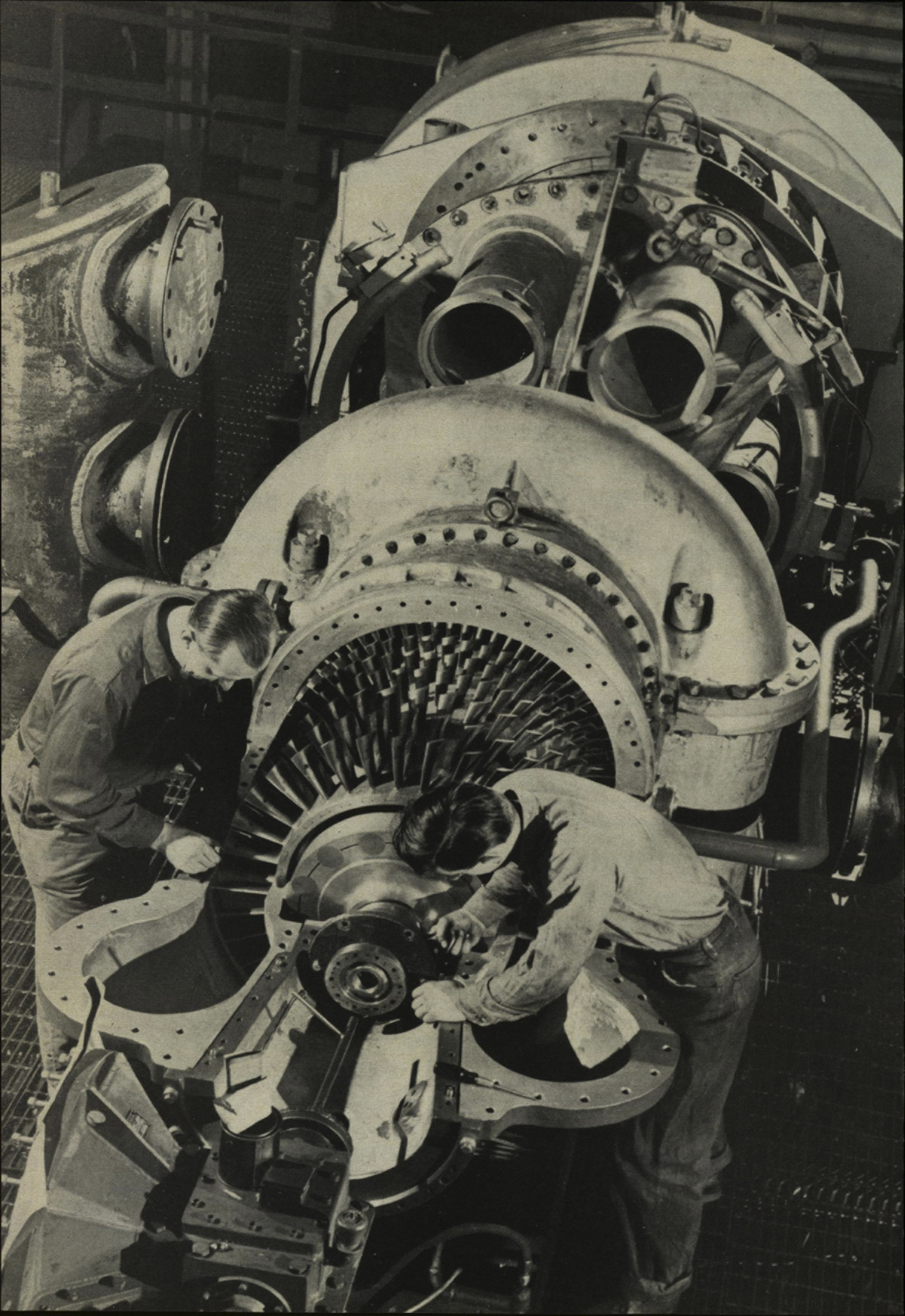


Five Years For Engineers?

A problem of great concern today is that of teaching engineering students all the courses and subjects deemed necessary for an engineering career in such a short time as four years. With the greater strides and ever increasing fields of the scientific world comes the task of passing the newly gained knowledge on to future workers. This means that not only must the older material be learned by the student but the latest developments must also be mastered in order to prepare him to meet the needs of his future job. It is most certainly true that this older material cannot be neglected since it is the basis for these new fields, and it is also necessary that the new work be included in the curriculum because it is the purpose of a college education to equip a student with an acquaintance with all the phases of his chosen profession. Is the answer, then, a five year course for engineering students?

A five year course would be successful in easing the load carried by present-day students, for the credit hours required now for four years would still provide for plenty of study over the five years, leaving room for some of the non-technical subjects necessary for a well-rounded engineering education. In the medical schools, for example, three years are spent in pre-medical study—a period which allows for many courses that are foreign to medicine but interesting to the student. A five year curriculum would also allow some of the higher credit-hours-per-semester courses to be spread over two semesters. If this were done, the student would benefit in two ways; he would have a lighter semester load and he would gain from a more thorough treatment of the course made possible by the extended time.

Such a program, however, is not without fault. There are several difficulties which might discourage such a plan, but they would be small in comparison to the benefits derived.

The first problem would be that of the effect on prospective students. The thought of a five year program might discourage some who otherwise would undertake engineering training. This would not be a stumbling block, however, since anyone who did enter into such a curriculum would be more likely to finish. The lengthened program would, in this case, serve as a preliminary "weeder" in routing those high school graduates who would have dropped out during the first year. Finances, too, would present a problem to the student. Many find it difficult to finance their way through even four years, especially in privately endowed schools.

There would also be the problem of an increased faculty staff. A decreased load on the student would probably mean an increased load on the instructing department in that more and varied subjects should be made available in order to break the monotony of too many technical courses. A larger faculty might prove to be "heaven-sent" in some instances because of the undermanned teaching staffs in some of the colleges today.

Of all the proposed solutions to the engineering student's problem, the five year curriculum seems to be the most desirable and, in the author's opinion, the one towards which definite steps should be taken.

R.D.M.

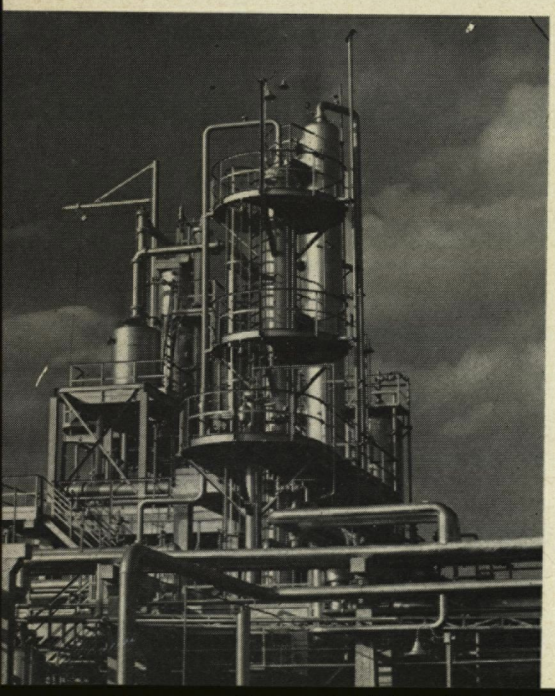
The Chemical Industry's Big

As you slipped into your lightweight plastic raincoat to run through the rain to your car, slid across plastic seat covers, and rode to town on synthetic rubber tires, the fact that all of these items (with the possible exception of the car) may have come from an oil well was, to say the least, remote.

The articles mentioned above are but a few of the scores of products of petrochemistry, one of the newest and most rapidly growing branches of the chemical industry. Petrochemistry, as some of our more shrewd readers may have guessed, deals with the making of chemicals from petroleum and, at the present more important, natural and refinery gas.

Actually, there may not even be such a thing as petrochemistry since, as all students of English (and economic geography) know, the root "petro-" means rock, not oil. While this mistake in nomenclature bothers some chemists and oilmen, the great majority ignore it the same way they ignore the fact that banana oil doesn't come from bananas. While it isn't likely that the name will be changed, Webster's dictionary does not list the word "petrochemistry", so this may be the only instance in which a business has become a multi-million dollar industry and exerted influence on an entire nation's way of life without having an official name.

Isobutylene Extraction Unit



To understand petrochemistry you must first be familiar with three related words: *cracking,* by which components of petroleum or natural gas are broken down into simpler materials to be used as building blocks; *synthesis,* which converts these building blocks into new forms to produce basic chemicals; and *polymerization,* which causes the building blocks to form chains, thus linking simple molecules into larger molecules called polymers.

Of these, synthesis is perhaps the oldest. Who doesn't remember reading of the attempts of the alchemists to make synthetic gold? The modern synthetic chemical industry started in 1856 with the making of dye from coal tar by a Briton. However, it wasn't until World War I when supplies from Germany were cut off that the synthetic dye industry began to boom in this country. Since then many other products have risen to the top of the synthetic heap, particularly the versitile plastics which have become an integral part of our American life.

On the other hand, polymerization is relatively new. In fact, it wasn't until World War II, when our normal sources of many raw materials were cut off, that it became a major industrial process. Today, polymers are resulting in thousands of synthetics, including materials never found in nature.

The polymer, as we have said, is something of a super molecule that has been built up out of simpler ones. In the transition from simple structures to complex ones, polymers often take on physical characteristics that were not available for man's use before.

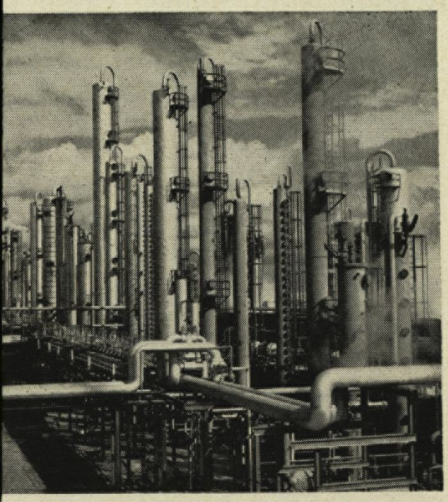
A Butadiene Plant Feed Preparation Unit

The art of making polymers is a field in itself. And it is a relatively unknown field since the chemist is not always certain of what goes on when he reacts molecules to produce a polymer. He does know that in the presence of a certain catalyst and under particular conditions of temperature and pressure some hydrocarbons will rearrange themselves and join together to form a definite polymer. In many cases he doesn't know just how they rearrange or exactly why, but it's lucky for us that they do.

The petrochemical industry possibly has more interdependence among competitors than does any other industry. There is a very logical explanation for this, As you know, when a simple reaction takes place between two chemicals to obtain a desired product one or two by-products usually result which, although of little or no use, must be reckoned with. As the reaction becomes more complex, the by-products increase in number. The same is true in making polymers. All along the route from the basic reactions to the

Baby

By Ralph Llewellyn, ch.e., soph.



Celanese Corporation of America's Chemical Plant

ctual polymerization the chemist inds that he has more kinds of mole-ules on his hands than he can use. Therefore, the company venturing in-o petro-chemistry must be con-erned not only with the desired pro-lucts but also with what can be done vith the by-products.

Take, as an example, the experi-ence of Celanese Corporation of America, one of the nation's largest producers of rayon fibers. The com-pany has a large plant on 1,200 acres near Bishop, Texas, which, to quote a few statistics, has a line of 101 frac-tioning towers, reacts 175,000 gallons of butane and propane a day requir-ing about 5 million gallons of water, 25,000 kilowatt hours of electricity and 35 million cubic feet of natural gas for fuel. The purpose of this layout is to convert propane and butane into acetone and acetic acid which are shipped to the company's eastern plants to be made into rayon. One-half of the plants production is the desired products, acetone and acetic acid. The other half consists of fifteen different chemicals not di-rectly related to the rayon industry. These fifteen chemicals are sold on the open market, thus, becoming raw materials for other companies.

Petrochemicals find their way into many everyday products. Take for example, the production of just one plant, the Dow Chemical Company's Freeport, Texas, plant. Here Dow uses the same gases used by the Celanese Corporation, propane and butane, but instead cracks them into propylene and ethylene.

Consider first the ethylene. Some goes into ethylene glycol which you will recognize as the permanent anti-freeze you use in your radiator. Some goes into insecticides and ethylene dibromide. The ethylene dibromide is used by the Ethyl-Dow Corpora-tion as a component of Ethyl anti-knock fluid. Of what's left, some goes into synthetic detergents; the rest into the making of ethylene dich-loride, a raw material for vinyl chlo-ride, which in turn, is a raw material for a plastic used for window screens and automobile seat covers, among other things. (You will recall that until recently, research was done by Rose's chemical engineering depart-ment on vinyl chloride plastics for the Detrex Corporation of Detroit, Michigan).

The propylene from the Freeport plant becomes propylene glycol which is used as a moistening agent in to-bacco and coconut and to help retard mold in bakery products.

Not only has petrochemistry pro-duced many new products, but it has also produced some old ones cheaper or of better quality than was before possible. Today, for instance, more than half the ethyl alcohol used in this country comes from ethylene gas rather than fermentation of grain, thus, releasing vast quantities of grain for stock feed.

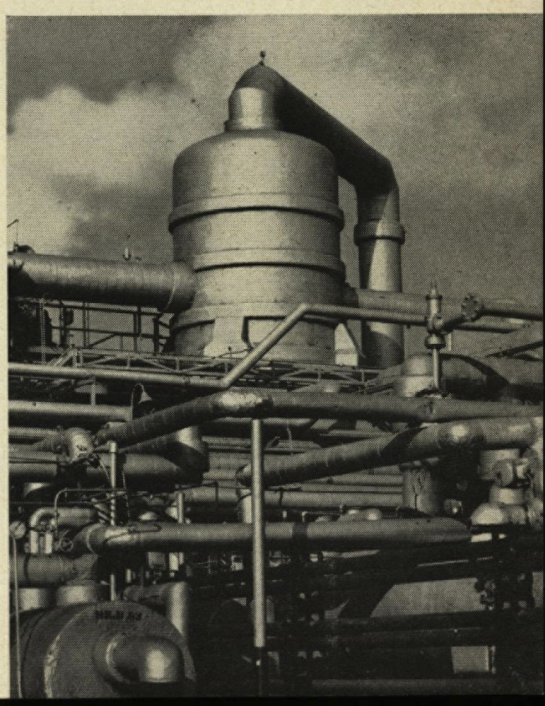
Sometimes even the petrochemical industry, which must necessarily look far ahead, meets an unforseen problem, such as this. The chemists developed synthetic detergents. As the synthetics began to check soap production it appeared as if the na-tion faced an acute shortage of gly-cerin, a by-product of soap manu-facture that has wide use in indus-try. But the chemists solved this problem quite handily; they de-veloped synthetic glycerin.

We could go on and on to the end of the magazine stating facts and il-lustrations that show how companies engaged in petrochemistry are not only competitors, but also each others source of raw materials and market for finished products and how it is one of our fastest growing industries.

If you think the petrochemical in-dustry is big, you're so right! In fact, no one knows just how big it is since statistics can't keep up with its rapid expansion. Already, it touches our daily life and is recognized as one of our prime industries for defense as well as peace. In the next twenty-five years not only our way of life, but our very existence may depend upon its accomplishments.

(*Concluded on page* 26)

Ethylene Refrigeration System in a Polymerization Section of a Butyl Plant



Palomar's Giant Eye

By John Rhodehamel, Fresh.

Since man first began to think and reason, the heavens have provided his imagination with a most fertile field. Until the time of Galileo, man could think of the heavens only to the extent of what the naked eye could see. Then, early in the seventeenth century, Galileo, with his crude instruments, viewed the planets of our solar system and began the first mapping of the heavens above us. Through the development and further use of the telescope, man has progressed rapidly in his quest for answers to the heaven's secrets.

One of the greatest steps taken in the development of astronomical instruments was the recent completion of a giant 200-inch telescope by the California Institute of Technology.

Prior to this time, a 100-inch telescope was in operation on Mount Wilson in California and was the largest mirror in existence.

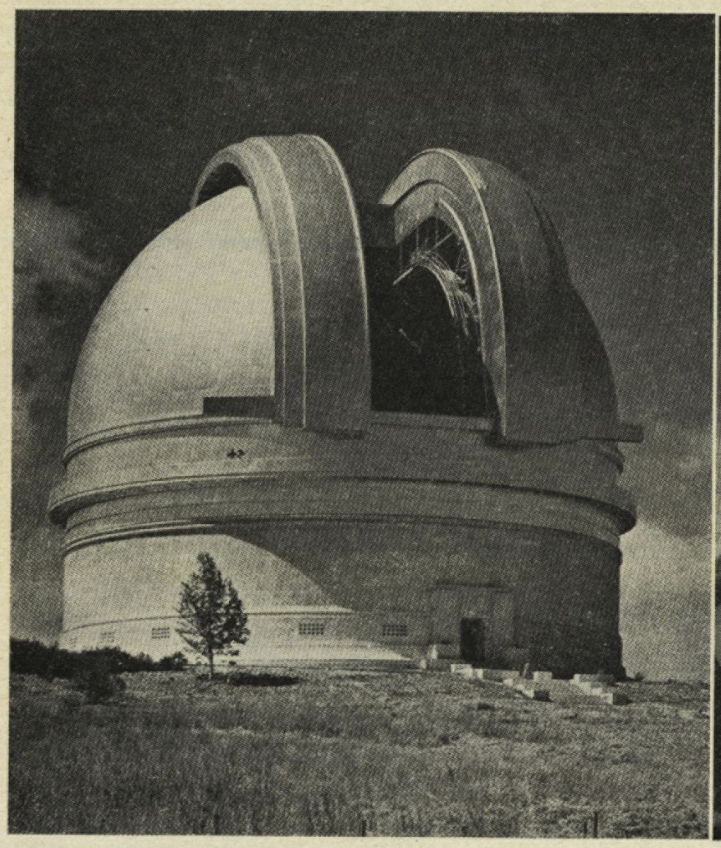
The idea and initial plans for the construction of a giant 200-inch mirror were conceived by Doctor George E. Hale in 1928. In that same year, Dr. Hale applied for and received funds in the form of a gift from the International Education Board to the California Institute of Technology to be used in building an astronomical observatory and laboratory. The whole layout, including the equipment on near-by Mount Wilson, is now the property of the California Institute of Technology. The observatory is operated jointly by the California Institute and the Carnegie Institute of Washington.

The building of the 200-inch telescope required not only 22 years an over six and one-half millions of do lars, but also every step of the pr cess of shaping the 17-foot reflectin surface required new experiment techniques and methods. Even th tests by which the giant glass wa proved to be correct, had to be d vised.

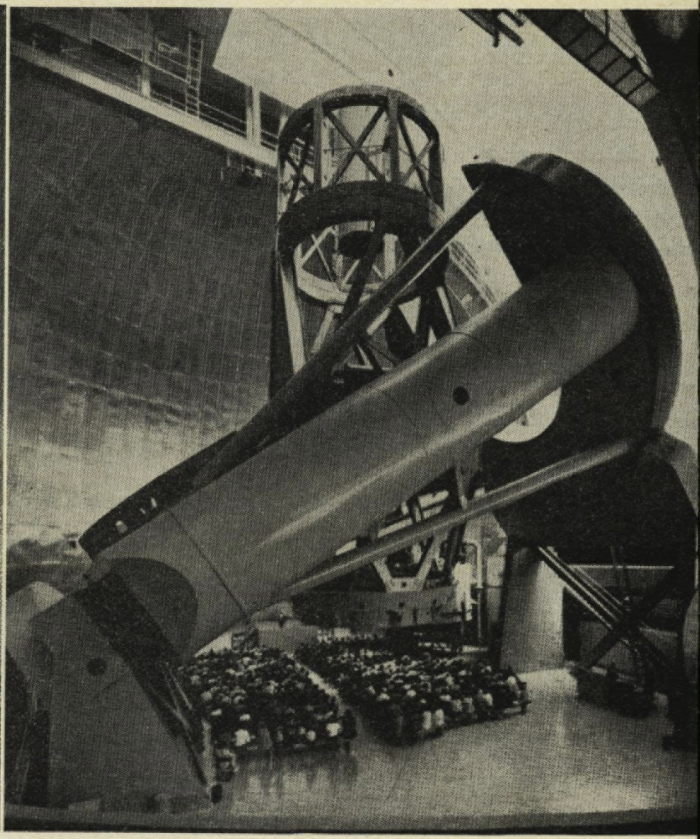
Through the results of many test it was found that Pyrex glass was th most successful for this particula project as Pyrex glass had greate strength than other types of glass the same time maintaining the te dency to resist expansion or co traction with changes in temperatur

After 6 years of research, the fir pour was made. This proved defe tive and a second disc was starte After the next pouring, the proble of cooling the great slab of gla

Mt. Palomar Observatory



200 inch Hale Telescope

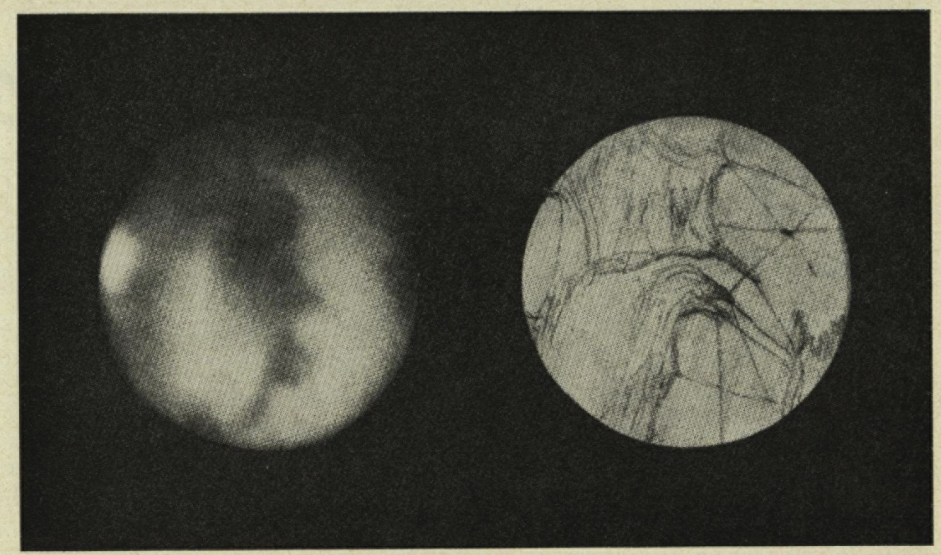


faced the Corning technicians for it required more than ten months to be cooled properly. This problem was solved by placing the slab in a cell-like room and surrounding it with electric heaters which maintained a constant temperature on all sides. Each day the temperature of these heaters was automatically lowered a little less than one degree. After the glass was cooled enough to be safely transported, the long, hard trek across the United States was begun. From New York to Pasadena, California, it was carried by train and by truck.

It was in Pasadena the real task began—the grinding and polishing of the glass slab. In a laboratory the slab was supported on edge and the polishing was done very slowly and painstakingly. The complete grinding and polishing process, which removed about five and a quarter tons of glass from the original twenty-ton slab, required nearly thirty-one tons of abrasive, which included four and a half tons of rouge for the final precision work. All of this work was done automatically with an apparatus which ground the crude slab to as perfect a glass parabola as was possible. This parabola, which slopes inward, is accurate to within two millionths of an inch. At its edge the mirror is about two feet thick and is about three and three-quarter inches thinner at the center. At the exact center of the finished mirror there is a circular hole, some forty inches across. In this hole was placed the world's largest refaracting telescope, which was formerly at Yekes Observatory. It should be understood that the 200-inch telescope is a reflecting mirror and therefore has no lenses.

After the grinding and polishing of the mirror was completed, the back of the mirror was coated with an aluminum spray. After this final process in the Pasadena shop, the mirror was ready for installation in the observatory atop Palomar Mountain.

The location of Palomar Mountain is perfect in respect to the work carried on there, for the nearest large city is San Diego, which is forty-five miles away, and at forty five ference such as factory smoke or city lights. The peak itself is a lonely block of virgin granite, about 6000 feet above sea level and anchored securely on granite some ten by thirty miles in area and about twenty miles in height.



Photograph Drawing

MARS

After the installation of the mirror, more problems arose. One of these concerned the constant danger of temperature change on the mirror's surface whenever the dome of the observatory was opened. This problem was solved by covering parts of the mirror with insulating foil and by using a dozen or more fans to circulate the air around the mirror. Any temperature change of more than 5 degrees would cause the glass to either expand or contract a few hundred-thousands of an inch. This minute distortion could ruin weeks of preparation made in advance for the photographing of some distant celestial body. The fans and insulating material reduced this distortion by an estimated 50 percent.

Another problem encountered was that of overcoming the elasticity of the glass in the finished mirror. The glass sagged here and there under its own weight, which produced more distortion of the image. To overcome this distortion, a complicated system of braces had to be invented, tested and applied before the mirror could be used. The telescope and tube, complete with its cage, is 55 feet long and weighs 140 tons.

When securely located and braced, the mirror is moved about in its varying positions by automatically functioning machinery which compensates for the earth's movement and holds the mirror to its exact parabolic curve. The telescope can be set to automatically seek a star's position and can be adjusted to follow it across the sky, controlled by either the astronomer in the cage or by his assistant at the controls below.

No one will "look through" the telescope, for the astronomer inside the cage will merely record on a photographic plate what the Schmidt cameras see in the 200-inch mirror.

The Hale telescope is not used alone in viewing the heavens, but is assisted by other optical pieces such as the 18-inch and 48-inch Schmidt cameras which are equipped with wide angle lenses. The functions of the 48-inch Schmidt-type telescope is to map the skies and to search for objects worthy of inspection by the 200-inch giant. In reality the big Schmidt telescope sees at a glance much more than the 200-inch, covering 36 square degrees in area; but the 200-inch pinpoints its vision on a field of only a quarter of a square degree in area.

Several enormous prisms will be employed to work in direct connection with the 200-inch mirror to study

(*Concluded on page* 28)

Library Notes

By Carson W. Bennett and Nina J. Mahaffey

"The history of the world is but the biography of great men."

February is the month which claims the birthdays of many great men. The two which flash to one's mind first are, of course, Abraham Lincoln and George Washington. The library has the following Lincoln books which merit your attention:

Angle, Paul M. *The Lincoln Reader.*

Lincoln, Abraham. *The Literary Works of Abraham Lincoln.*

Sandburg, Carl. *Abraham Lincoln.* This is the monumental work which Carl Sandburg wrote after an investigation of Lincoln lore. This search was made to satisfy his curiosity about the greatness of Lincoln. His conclusion was that Lincoln was even more eminent than previous biographers had led us to believe.

Tarbell, Ida M., ed. *Selections from the letters, speeches, and state papers of Abraham Lincoln.*

You will find the following books in the library concerning the "Father of Our Country."

U.S. George Washington Bicentennial Commission. Special news releases relating to the life and times of George Washington.

Washington, George. *Speeches and letters of George Washington, Feb.* 22, 1732 — Dec. 14, 1799.

Irving, Washington. *Life of Washington.*

Lossing, B. J. *Washington and the American Republic.*

As February makes biography seem unusually important, we call your attention to the following outstanding and recent ones:

Haraszati, Zoltan. *John Adams and the Prophets of Progress.* The story of the nation's second president.

Pearson, Hesketh. *Dizzy;* the life and personality of Benjamin Disraeli, the great Victorian Statesman.

Frank, Waldo D. *Birth of a World:* Bolivar in terms of his peoples. Bolivar was the George Washington of South America.

Cibulka, Alvis. *All This Could Happen Only to an Engineer.* This one should be intriguing to a fledgling engineer.

Cameron, Frank, *Cottrell; Samaritan of Science.*

De Forest, Lee. *Father of Radio;* the autobiography of Lee De Forest.

Campbell, Murray. *Herbert H. Dow, Pioneer in Creative Chemistry.*

Matthiessen, Francis O. *Theodore Drieser.* This is the story of the famous literateur.

Crawford, Marion. *Elizabeth the Queen.* The story of Britain's new sovereign.

Franklin, Sidney. *Bullfighter from Brooklyn.*

Sievers, Harry J. *Benjamin Harrison, Hoosier warrior,* 1833-1865.

Martin, Edwin T. *Thomas Jefferson, Scientist.*

McKie, Douglas. *Antoine Lavoisier: Scientist, Economist, Social Reformer.*

Dillon, Mary Earhart. *Wendell Willkie,* 1892-1944. The story of a noted Hoosier.

There is much to be gained in the way of inspiration and pleasure from biography. Try reading one in honor of the month of great birthdays.

Rose Men Get 30 Days

Do you have trouble reading a book in the normal two-week library loan period? Do you find that it's a nuisance to take care of renewals? Are you irritated with fines on your overdues?

Well, here's good news for you! A of the regular circulating books whic formerly were loaned for only tw weeks can now be borrowed for 3 days from the RPI Library. That right—a full 30 days to read almo any book in the library. That reall makes it worthwhile to carry the home, doesn't it?

Of course, this extension of th loan period does not affect the per odicals, reserve, or reference colle tions. Periodicals, other than curren still circulate for one week, reserv books may be borrowed for ove night only, and reference books d not circulate at all.

Just for the record, we will hav to say that this is a temporary chang in regulations. But if it works, an we can see no reason why shouldn't, the 30 day loan period wi be here to stay.

How about stopping by for tha thicker than average book that you'v been wanting to read but didn think you could manage in a measl two weeks? 30 days is more tha twice as long.

Liquid Library

After all these years, we though that we had heard about all of th different kinds of special libraries Now, we just discovered a new one

According to an ad in "The Wal Street Journal," Schenley Distiller Inc. has "America's largest liquid library." Here only the faculty may use the resources—hundreds of bot tles containing different samples o *Spiritus frumenti.*

Luck is what happens when prepa ration meets opportunity.

How the Petroleum Industry Helped Solve the Nation's Benzene Shortage!

From these giant towers at Standard Oil's Whiting, Indiana refinery comes benzene, a product urgently needed by America's booming industries. The petroleum industry's hydroforming process is helping to solve the critical benzene shortage that threatened the nation.

HIGHLY-SKILLED chemists in well-equipped laboratories may come forth with anything from a new spray for protecting apples against disease and insects to a method for synthesizing benzene from crude oil fractions.

In the latter case, petroleum industry scientists had to run a race with a threatened critical shortage. Production of such things as synthetic rubber, nylon, styrene and phenol plastics, aniline dyes, sulfa drugs, insecticides and certain types of military explosives was endangered.

By use of the hydroforming process, which Standard Oil scientists helped to perfect, our technical men synthesized benzene from petroleum naphthas—and in large quantities.

In fact, at Standard Oil's Whiting, Indiana plant, benzene production capacity has risen in the past year to 16 million gallons. In addition, according to the Petroleum Administration for Defense, other refineries ultimately will produce many times this amount as the petroleum industry's answer to the chemical industry's urgent need for large additional quantities of this vital fluid.

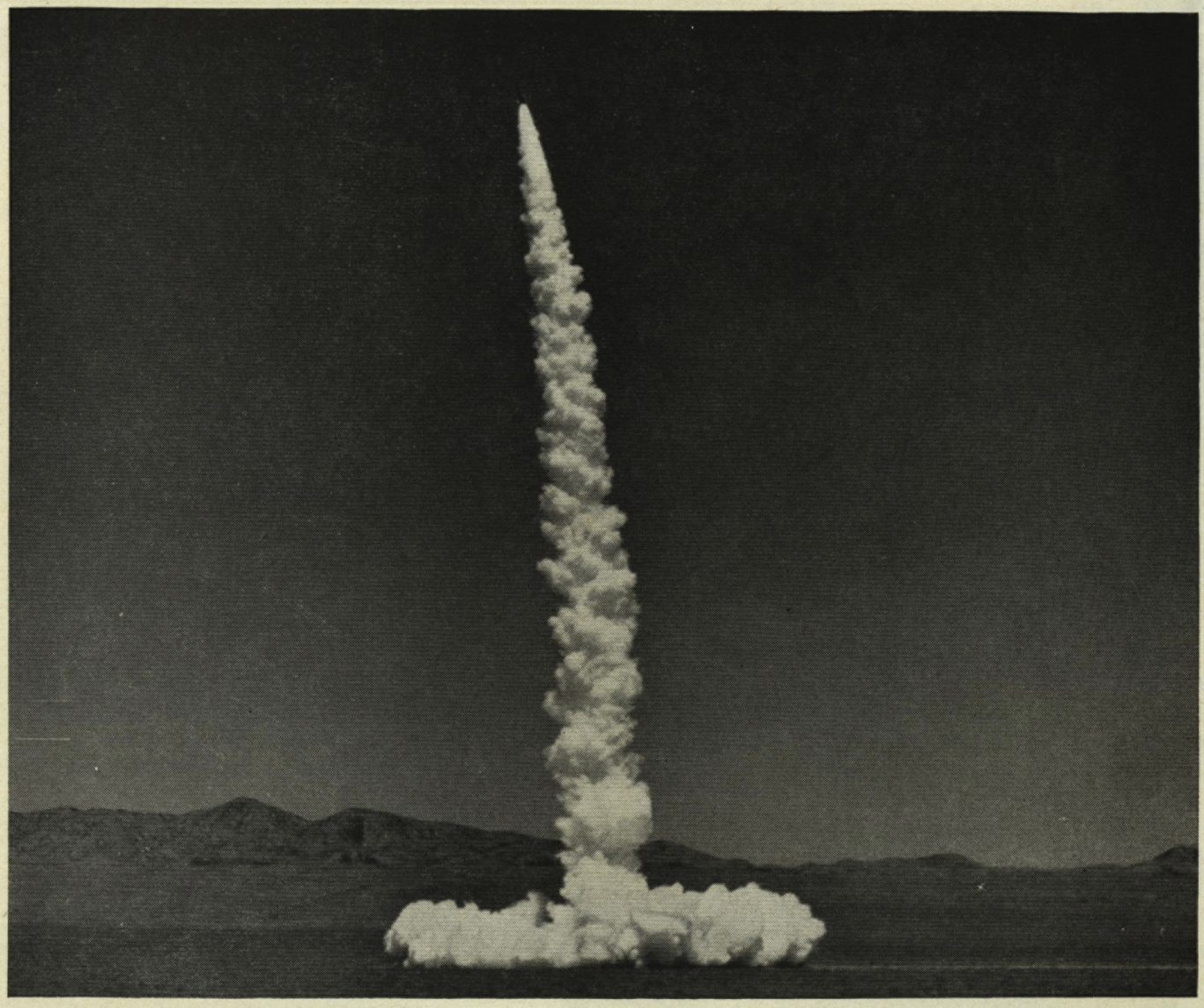
Success in producing benzene commercially is only one of the many benefits derived from the petroleum industry's more than $130 million annual expenditure on research and technical services.

At Standard Oil alone 2,500 persons devote full time to research and engineering. Young college-trained technical men will find the wide variety of subjects under investigation and the keen competition in the petroleum industry stimulating to scientific thought.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD



Engineers get ahead at Boeing

A major guided missile program is just one of Boeing's many projects-with-a-future. Other programs, which offer *you* plenty of room to get ahead in engineering, are America's first-announced jet transport project, research in supersonic flight and nuclear-powered aircraft, and development of the B-47 and B-52 jet bombers, the airplanes that have given Boeing more experience with multi-engine jets than any other company.

No other industry approaches this one in offering young engineers such a wide range of experience, or such breadth of application — from pure research to production design, all going on at once.

Aircraft development is such an integral part of our national life that young graduates can enter it with full expectation of a rewarding, long-term career. Boeing, for instance, is now in its 36th year of operation, and today employs more engineers than at the peak of World War II.

Boeing engineering activity is concentrated at Seattle in the Pacific Northwest and Wichita in the Midwest. Both communities offer fine fishing, hunting, golf, boating and other recreational opportunities. Both are fresh, modern cities with fine residential and shopping districts, and schools of higher learning where engineers can study for advanced degrees.

There are openings in ALL branches of engineering (mechanical, civil, electrical, aeronautical and related fields) for work in aircraft **DESIGN, DEVELOPMENT, PRODUCTION, RESEARCH and TOOLING.** Also for servo-mechanism and electronics designers and analysts, and physicists and mathematicians with advanced degrees.

For further information, consult your Placement Office, or write:

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Company, Seattle 14, Washington

BOEING

Your guardians of quality in radio, television and recorded music

When you see these trade marks on television sets, radios, "Victrola" phonographs, and other electronic instruments you are always assured the highest quality—born of leadership in research, fine engineering and craftsmanship.

The sun never sets on these trade marks, and millions of people around the world turn to them with confidence.

RCA, as the pioneer in the field, continues to lead in every major advance . . . in all phases of television.

RCA Victor has made radio a household word to millions of Americans. "Victrola" phonographs have extended great music from concert halls to homes everywhere, from Broadway to Every Street, U.S.A.

You also see these trade marks on records so rich in "living presence" that artists seem to be performing in your home.

Little Nipper and the familiar phrase "His Master's Voice" have appeared on recordings made by the world's greatest artists —for more than half a century.

These same high standards of quality make NBC the nation's leader in radio and television broadcasting. You can depend on RCA and RCA Victor trade marks as *guardians of quality*—sure guides to finer performance, dependability, better value and service.

Tmks. ®

CONTINUE YOUR EDUCATION WITH PAY—AT RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products —offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short-wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to College Relations Division, RCA Victor, Camden, New Jersey.
Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RCA *RADIO CORPORATION OF AMERICA*

World leader in radio—first in television

Campus Survey

By Jack Farell, ch.e., jr.; Jack Freely, c.e., jr.; and Herb Smith, e.e., soph.

Campus Mischief

The latest bit of "tom-foolery" to take place between the ravaged and preditory sophs and freshmen is that of open warfare using an object in the form of a frozen spherical missile, commonly known as a snow ball. Due to the large number of freshmen and the ever decreasing number of sophomores, a few gallant second-year men have been almost thoroughly "snowed under." As an allied expeditionary farce, however, some members from the three older classes have driven the freshmen back to their sanctuary of the dormitory. Other occurances around the "capitol building" have included some foolishness between the junior and senior classes. It has been fun most of the time, although there have been bitter feelings in some instances. The whole affair began when a raider group of juniors abducted the seniors sole prize possession, the Senior Bench. For weeks the seniors apparently didn't even know it was gone because not even a whimper was heard from the old men of the mountains. At long last their fury was bent to a point of irrationality. An ultimatum of surprising inaccuracy was posted in the public square, and signed in blood. As the time stated in the demand ran out, the master-minds prepared for retaliation. As quickly as a snail they struck with the ferocity of a sick cow on a small bond of brave and unrelenting juniors. Held to a draw at this point, the seniors then used gestapo-like methods to obtain information which they already knew. The seniors placed the bench back on its supports, but within a few short hours it was back in the hands of the juniors, with the help of some freshman. The junior class then had "Remember '54" inscribed on the slab, and proceeded to return it to its rightful resting place. The big, bad wolves didn't approve of this, and the bench was removed again. First they want the bench, and now they don't—will they ever make up their finicky minds?

Football Assembly

On Thursday, December 18, Coach Phil Bromn conducted an awards assembly for the football team. The new sweaters and jackets were put into service at this time. The new award sweaters are black with a red letter. On the letter is a symbol describing the sport in which the letter was earned. The new jackets are red with black sleeves and can be won by juniors and seniors who have won two previous letters in the sport. Previously only seniors could win jackets.

All members of the football team were given gold footballs, regardless of whether they had won letters or not. It was announced that Rose would have co-captains next season. The two men designated are Erwi Ulbrich and Bob Rader. Since onl two members of last seasons squad Capt. Jim Mook and Howie Davis are seniors, Coach Brown thinks tha next year's team should be a goo one. Here's hoping that he is right

Ouch!

McKendree handed Rose's Engine ers their second defeat of the season 98-72, on the winner's court. Ros fought hard all the way but McKend ree could not be overtaken.

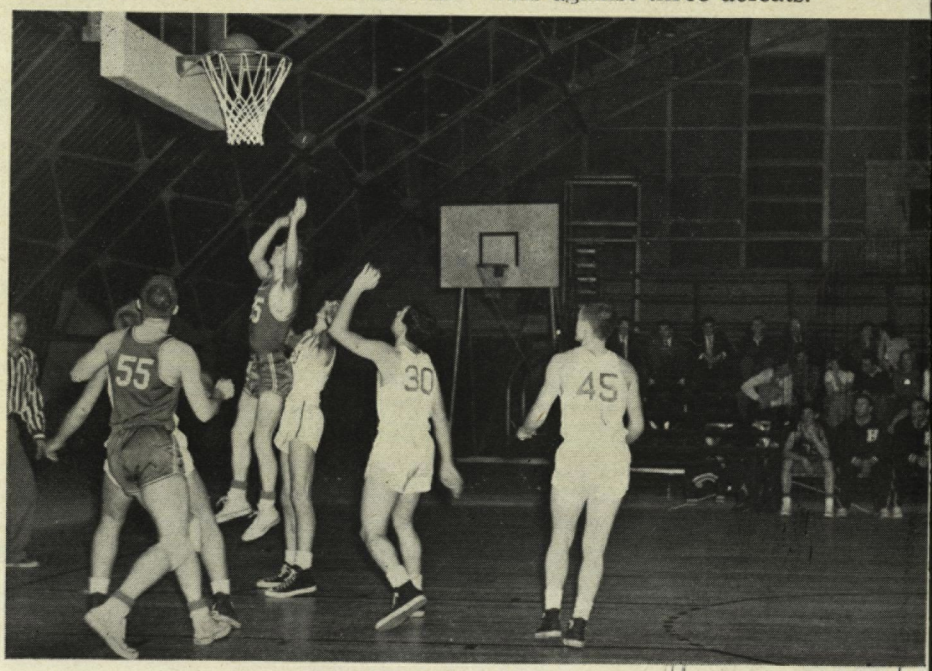
At the close of this game Rose stil led all other Hoosier independent col leges with a seven and two record.

Engineer's Fall

Rose fell to Earlham, 76-54, for th second loss in a row and the third o the season. The Quakers held th Fighting Engineers at arm's lengt by throwing up a tight and efficien zone defense.

Badger, Zorman, and Snape led th Rose scoring with 12, 10 and 9 point respectively.

Rose's record now stands at seve wins against three defeats.



Rose's Hardwood Heroes

Out of the grimy scrap pile come

BETTER STEEL PRODUCTS

How Republic Steel Research is Helping Machine Tool Users...and You!

● An oily mess of steel chips under a machine! So much steel scrap? . . . Yes, but scrap that can tell an important story about the machinability of steel.

Republic metallurgists know that. So they take samples of chips cut from various steels. They study them—measure changes in hardness—right down to each tiny grain of steel.

That's just one of the ways in which Republic has learned so much about the intricacies of steel. There are many others—each a part of Republic's continuous program of research to improve its 3-FOLD SERVICE FOR STEEL USERS.

Here it is:

1. Production of the *best-possible* steels and steel products—thousands of them.
2. Recommendation as to which steel or steel product will do a specific job best.
3. Assistance in developing the most efficient and most economical method of processing or fabrication to achieve the desired end result.

This doesn't necessarily mean that Republic works miracles for steel users . . . but it does mean that Republic keeps alert to changing requirements—that Republic is vitally interested in its customers—and that these working policies help to make Republic a good place to work, a good place to stay.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

REPUBLIC STEEL

Research and Development

Edited by John Sawyers, m.e., jr.; William Cade, fr.; and John Chinn, fr.

Further Progress With Rotating Machine Insulation

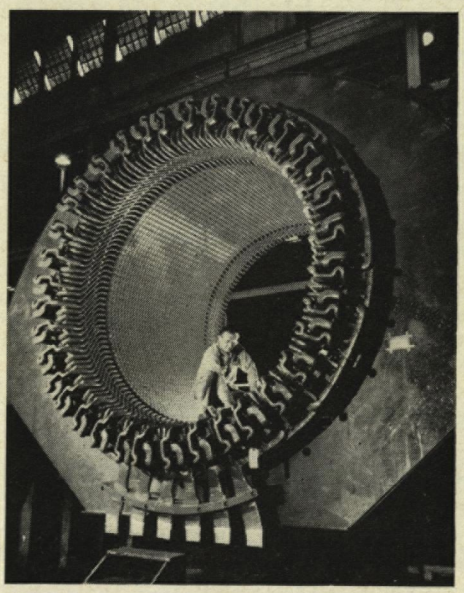
Two years ago a radically new coil insulation for high-voltage rotating machines was introduced. It was composed of mica and solventless synthetic resins and is known as Thermalastic insulation. Already 100 large generators totaling 5 million kva have been built or rebuilt using this solventless synthetic insulation. Some machines with Thermalastic insulation have been in service three years. The results with this type of insulation have fully supported the anticipated advantages: higher dielectric strength, better moisture resistance, and elimination of tape-separation problems on long turbine-generator coils.

Though Thermalastic was developed initially for the long coils of high-voltage generators, it has so many good electrical qualities that similar insulation has been sought for low-voltage machines. Research and materials engineers have come up with a variation of the original, high-voltage Thermalastic insulation but custom built for the somewhat different problems posed by large motors and generators of 6600 volts and down to about 1000 volts. Here tape separation, which sometimes results with asphalt-type insulation after many temperature cycles, is less likely because the coils are much shorter. On the other hand, resistance to moisture, corrosive atmospheres, and good dielectric strength are sought. The new low-voltage insulation is based on a synthetic resin compounded and applied somewhat differently than high-voltage Thermalastic, and is much more quickly cured. Advantages by comparison with present conventional insulations include greater mechanical strength, better heat transfer qualities, superior dielectric strength, and exceptional resistance to moisture and other contaminants. It also offers the great flexibility required for easy applications.

Thermalastic insulation was originally available only in the half coils (i.e., coils built and installed one side at a time) used in high-speed generators. Use on the full coils of waterwheel generators presented a different problem because of their larger dimension and called for new facilities. The first waterwheel generator with Thermalastic insulation was a 29,000-kva machine at Jordan Dam. It was rewound only a year ago. Extensive new facilities for the impregnation of coils used in waterwheel type machines with this new synthetic-resin bare insulation will be completed in a few months.

More Lights From Same Watts for Home Movies

The home-movie fan is forever seeking greater brilliance for his pictures. Projection-lamp designers have recently given him a big assist toward his objective. The results of their improvements vary with the optical system of the projector.



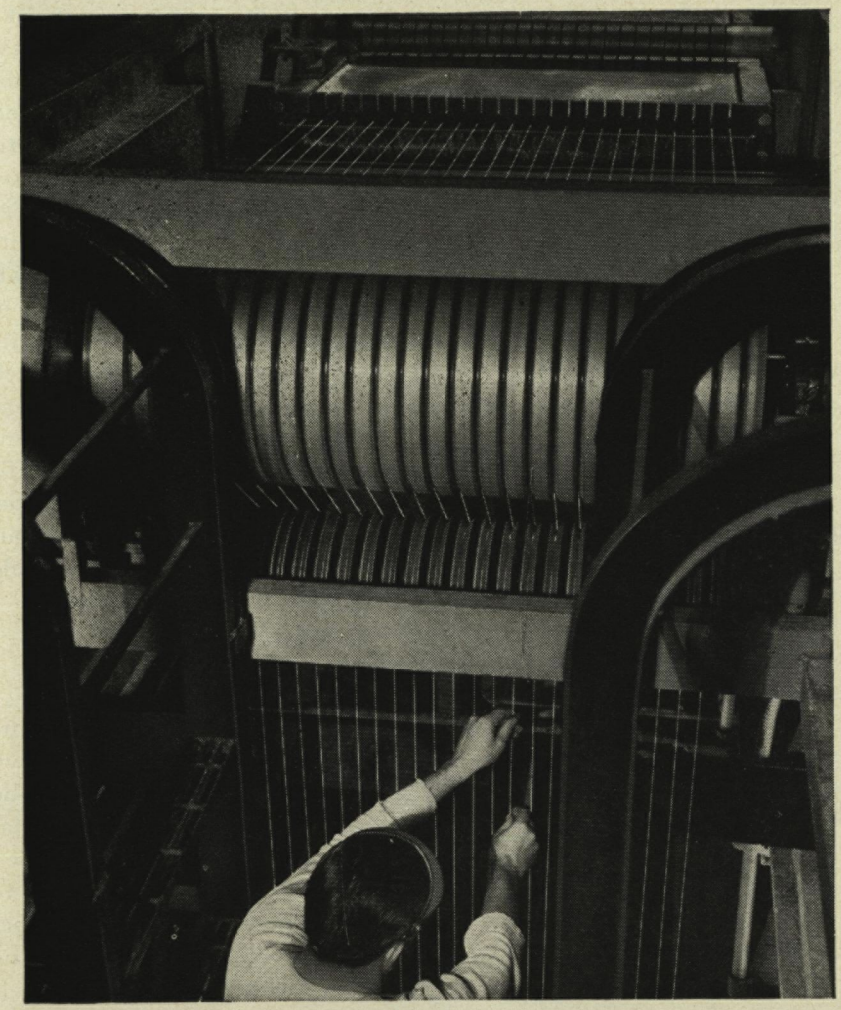
Giant Motor with Thermalistic Insulation

The problem is to make the maximum number of lumens produced by the lamp available to the optical system for projection to the screen. The filament construction used in the high-wattage projection lamps (500 to 1000 watts) consists of two parallel rows of coiled tungsten wires, staggered so that the coils of the second row are seen between those of the first row. This gives the appearance of a solid array of filaments. However, an optical system can perfectly focus the light from one plane, but not both, small though the distance be. The need has been to reduce the separation of these two rows.

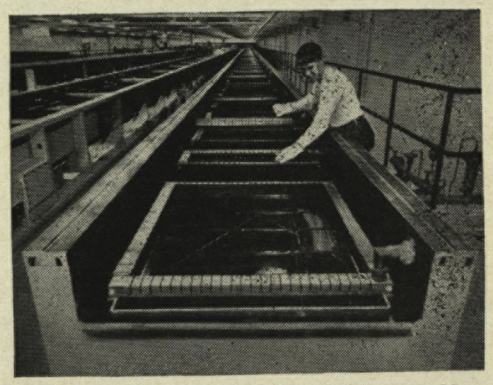
Heretofore, the filaments were hand formed and assembled. But the work of most careful operators is not without variation, which means an appreciable spacing between the plane of the two rows of filaments. A machine has now been developed for forming the filaments. Since they are much more accurately formed, the space that must be allowed between rows can be reduced by 15 percent. Also the distance between individual coils in each row can be reduced by 20 percent. By virtue of of improvement in the metallurgy of tungsten wire, the coils can be wound tighter.

This packing of the filaments closer together raises their average temperature and hence their light-producing efficiency as well as their effective physical concentration in all three dimensions. All this requires a slightly higher gas pressure, and this in turn reduces the rate of evaporation of tungsten and hence lengthens lamp life. The filaments are supported at the base end by what is known as a "floating bridge." It is a

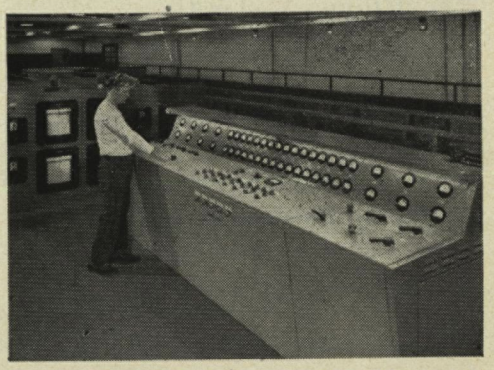
(*Continued on page* 20)



25 strands of steel wire start on their way to be electrolytically coated with copper, lead and brass.



Part of the 600 foot long electroforming machines where wires go through successive baths of plating solutions.



Console of controls for entire process is readily operated when necessary, even though seldom used in the almost fully automatic operation.

ENGINEERING . . . with a pioneering twist

There's a real incentive in working out ways to do things that have never been done before. And problems in pioneering are constantly cropping up at Western Electric—manufacturing unit of the Bell Telephone System.

For example: the revolutionary electroforming process dreamed up and made a reality by Western Electric engineers for making copper coated steel wire.

The big idea was this: Could a process be developed in which successive coats of copper, lead and brass would be deposited on steel wire electrolytically in one continuous operation?

Engineers of varied skills—electrical, mechanical, chemical, metallurgical, civil—went to work as a team. After solving many problems, they came up with a process that makes better, stronger wire at lower cost—does it at the rate of 1¾ billion feet per year.

Recent developments such as microwave radio relay networks for telephone calls and television programs—operator and customer dialing of long distance calls—secret electronic equipment for the Armed Forces—promise an ever-widening field for young engineers of varied training at Western Electric.

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

Research and Development

(*Continued from page* 18)

means of insuring that the filaments always return to their original position when they cool. Also it prevents filaments from vibrating when hot.

New Applications For Selenium Rectifiers

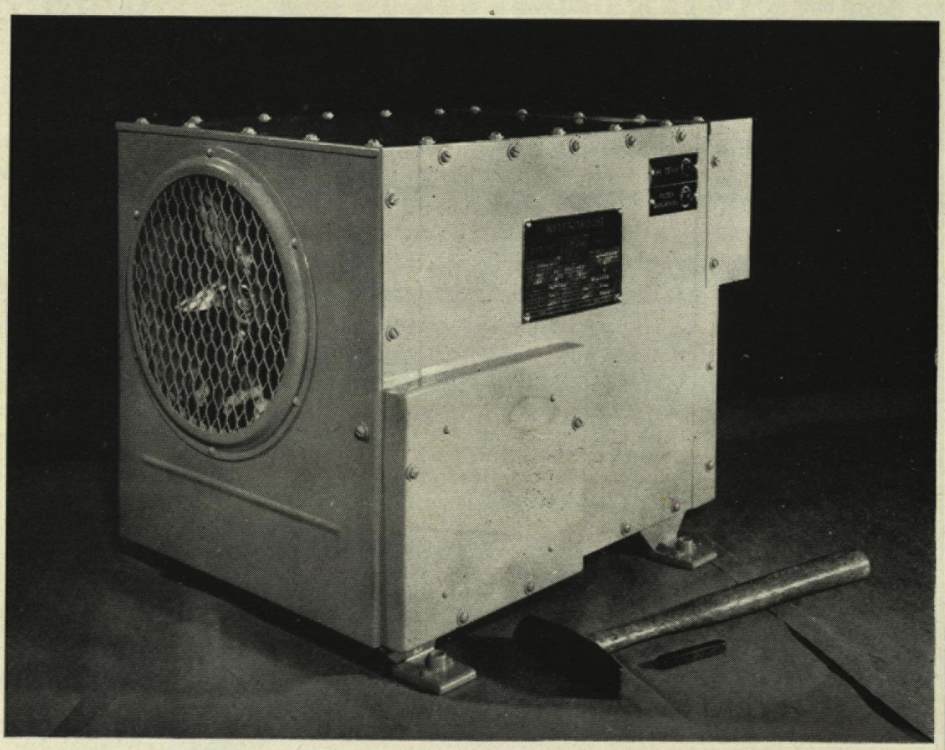
On many airplanes power is generated at 400 cycles alternating current. But considerable quantities of d-c power are also required. Selenium-rectifier units effect the exchange. These units are remarkable particularly for their light weight for a continuous output of 200 amperes at 28 volts (5.6 kw); the unit weighs but 72 pounds. This includes a three-phase transformer, and a saturable reactor and a carbon-pile regulator to maintain voltage constant. At normal input voltage the output voltage is constant to 200 percent load. The unit uses the high-voltage (33-volt) selenium cells, and is fan cooled.

The new applications for power selenium rectifiers are of endless variety. One is to provide power for d-c motors driving air compressors for the pneumatic system that whisks mail through tubes under the streets of New York City. Direct current is provided by four 150-kw banks and one 200-kw bank of selenium rectifiers. Each rectifier consists of 50-kw rectifiers banked to provide the desired rating. The three or four units comprising a bank require no equalizer connections to enable them to operate in parallel. These units weigh only about one half as much as motor-generator sets, require much less maintenance, and are comparable in cost. Their full-load efficiency is maintained down to quarter load and the stand-by losses are but one-fourth of those of a comparable m-g set. (See photo below.)

Better No-Load Tap-Changer Mechanisms

Parallel conductors carrying current in the same direction are drawn together by the interaction of the two magnetic fields. This fundamental principle of physics is used in a new tap-changer mechanism to provide a vastly improved contact structure having longer life. In the usual tap-changer device, contact is made by forcing a metal wedge between fingers pressed tightly together by spring pressure. With this

(*Continued on page* 30)



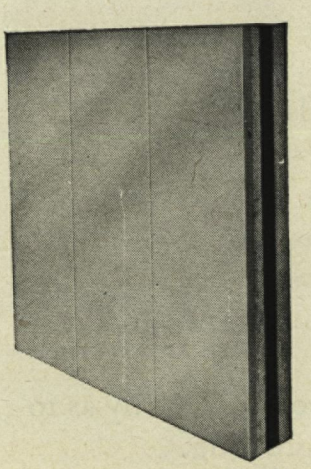
Aircraft Selenium Rectifier

What's Happening at CRUCIBLE

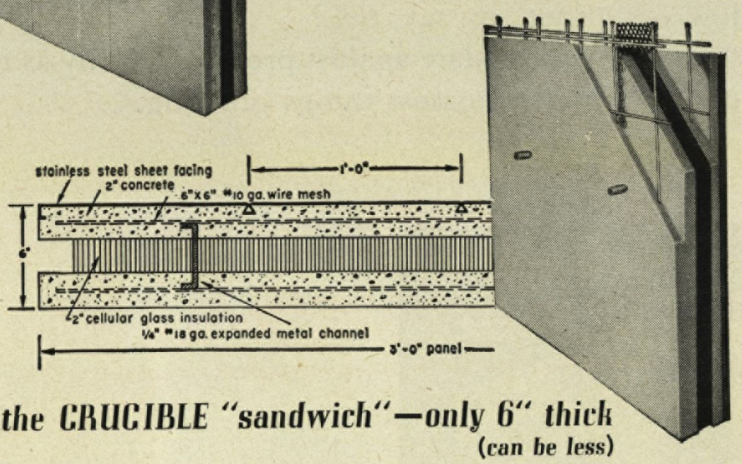
about stainless curtain walls

Modern construction methods have changed walls from the self-supporting type to a mere covering which does not support its own weight for more than one or two stories. Hence the definition of "curtain wall":—the facing or enclosure of the structural steel frame. This frame supports the entire weight of modern buildings.

The need has existed for a covering that would not only clothe the building, but be lightweight, economical and space saving. Because these requirements are more than adequately met with stainless steel curtain wall construction, this method is becoming increasingly popular with cost and space conscious owners, builders and architects.



the CRUCIBLE "sandwich"



the CRUCIBLE "sandwich"—only 6" thick (can be less)

Crucible stainless steel curtain wall panels are in the form of 6-inch thick "sandwiches". The facing consists of flanged, light-gauge stainless steel sheets with a factory, or site-fabricated, sandwich consisting of cellular glass insulation between two layers of concrete with connecting reinforcing. Crucible 18-8 stainless as the outside face offers excellent resistance to weather and fire while providing eternal beauty with a minimum of maintenance; the inside face can be finished or painted to suit the requirements of modern building interiors. Since 18-8 is restricted in use, a good substitute material, type 430 stainless, now government decontrolled, offers the same benefits as 18-8 stainless.

moisture penetration

The unique characteristics of the cellular glass insulation stop moisture vapor migration from one face of the panel to the other. The cellular insulation properly designed and installed assures that condensation will not take place *anywhere* within the sandwich.

insulation

Although less than half as thick as the usual wall construction, this Crucible stainless steel panel construction has more than twice the insulating value. The "U" value (overall thermal conductivity) is approximately 0.15 BTU Hr./Sq.Ft./°F.

fire resistance

The Crucible sandwich met the requirements of a standard 4-hour fire test conducted in the testing laboratories of the National Bureau of Standards. This meets all old building codes and is double, or better, the requirements of modern enlightened building codes.

erection and fabrication

Since a building frame is not precision built, the attachment of the panel walls to the frame is done with fastening devices that provide necessary 3-dimensional adjustment. Panels can be made at the building site, and a 24-hour casting-to-fastening cycle is possible.

technical service available

Though the use of some stainless steel is now restricted, Crucible metallurgists and development personnel are continuing to investigate improved methods of curtain wall and other construction so that better buildings can be built when stainless is more freely available. For more information write: CRUCIBLE STEEL COMPANY OF AMERICA, General Sales and Operating Offices, Oliver Building, Pittsburgh, Penna.

CRUCIBLE first name in special purpose steels

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Midland Works, Midland, Pa. • Spaulding Works, Harrison, N. J. • Park Works, Pittsburgh, Pa. • Spring Works, Pittsburgh, Pa.
National Drawn Works, East Liverpool, Ohio • Sanderson-Halcomb Works, Syracuse, N. Y. • Trent Tube Company, East Troy, Wisconsin

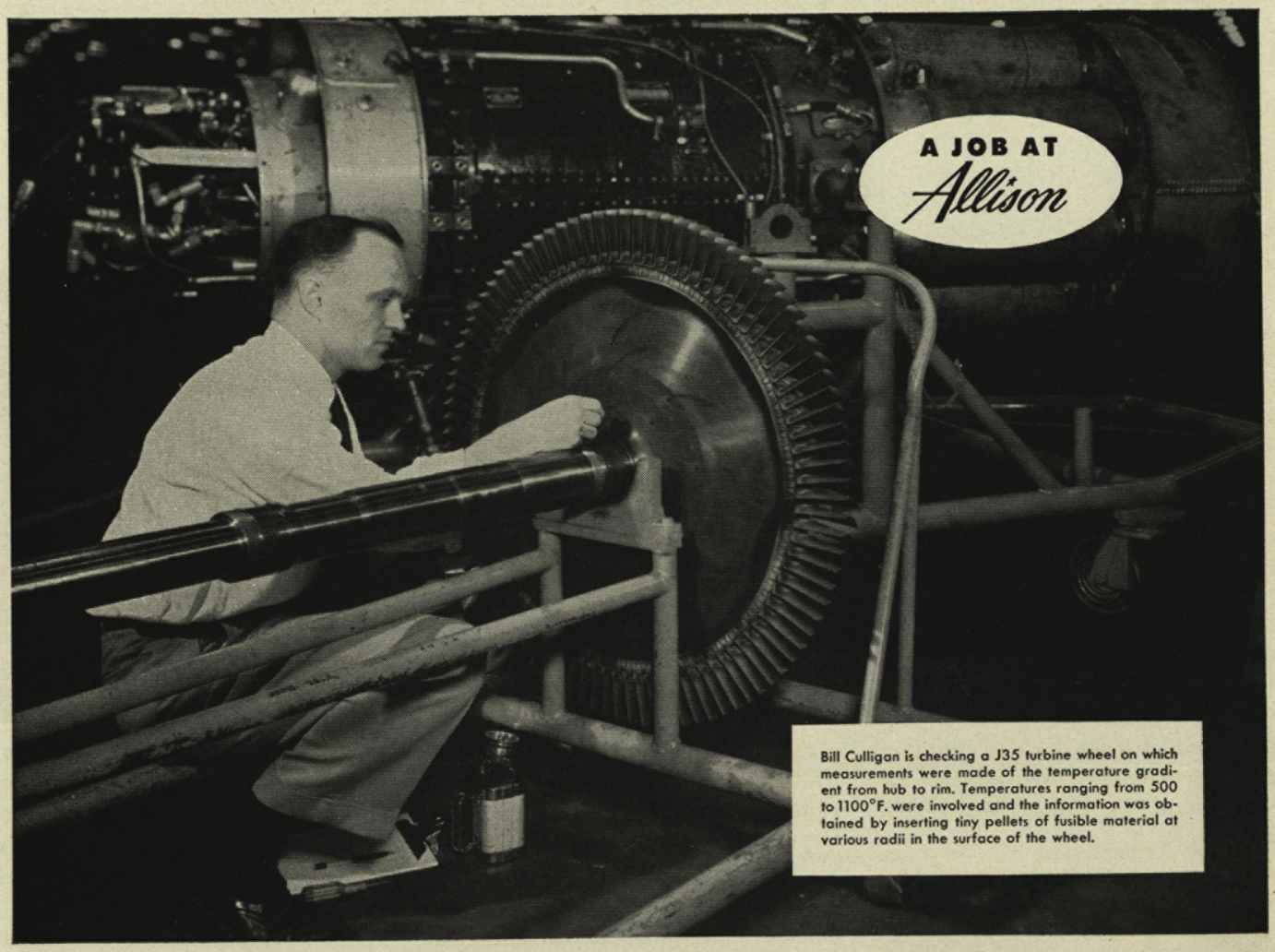
Somebody ought to speak sharply to Nature

THERE's a lot of loose talk these days about profits, attacking them as though they were evil.

The very existence of the world depends on profits; the *improvement* of the world depends on *big* profits. A farmer plants one potato and usually gets back 15. Even allowing for all his costs, that's more than 1000% profit! He plants one pound of corn and gets back 336 pounds—that's 33,600% profit. These are big profits. Is that bad?

Should the farmer be scorned as anti-social? Should his "excess" profit (whatever that is) be taken away from him? Should he be told that from now on he must limit his "profit" to, say, 6%?

To legislate against profits is as silly as to legislate against things growing.



Bill Culligan is checking a J35 turbine wheel on which measurements were made of the temperature gradient from hub to rim. Temperatures ranging from 500 to 1100°F. were involved and the information was obtained by inserting tiny pellets of fusible material at various radii in the surface of the wheel.

● William L. Culligan, Jr. received his B.S. and M.S. degrees in Aeronautical Engineering from the University of Michigan in 1945 and 1947. His first two years with Allison as a junior engineer were devoted to gaining direct experience in the operation of jet engines in the Experimental Test Department. In December, 1949, Bill was promoted to Experimental Engineer and has been specializing in applying improved instrumentation to jet engines as a means of obtaining better data for analyzing and predicting their performance. This has included some special "jet rakes" to obtain pressure and temperature data in the hot jet exhaust of engines on the test stand and in flight. There also were such things as quartz windows and periscopes to permit viewing the combustion inside the engine.

On one occasion he spent six weeks assisting in Air Force tests of an Allison engine at Eglin Field, Florida, where the inlet air temperature to the engine was varied from minus 65°F up to a "hot day" temperature of 110°F.

Today Bill is considered one of our experts on analyzing engine performance. He is only one of several hundred engineers who have interesting and important jobs in Allison's growing program of development and improvement for turbo-jet and turbo-prop aircraft engines. We think you, too, would like to work for the only manufacturer whose jet engines have accumulated more than 2,000,000 hours in the air.

Allison is looking for young men with degrees in

MECHANICAL ENGINEERING ELECTRICAL ENGINEERING AERONAUTICAL ENGINEERING

A lesser number of openings exist for majors in Metallurgy, Electronics, Mathematics and Physics

For further information about YOUR engineering career at ALLISON, discuss it with your Placement Counselor and arrange for an early interview with the ALLISON representative the next time he visits your campus. Or, write now for further information: R. G. Greenwood, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

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Alumni News

By Lawrence Ogborn, e.e., jr.

'96 Peter W. Klinger of Dayton, Ohio, president and founder of Klinger-Dills Company of that city, died November 2, 1952, at Ocala, Florida, after a brief illness while on vacation. "Pete," as he was called by all his friends, had been in Dayton since his graduation from Rose. He was associated as an engineer with several firms in Dayton prior to purchasing the More Belting Company in 1917, which later became the Klinger-Dillis Company, distributors of power transmission machinery.

'99 Mr. Frank J. Jumper, E.E., died October 30, 1952. Mr. Jumper had been retired but was formerly General Mechanical Engineer with the Union Pacific Railroad.

'05 Captain Owen L. Wood, M.E., of Santa Fe, New Mexico, is pictured after his retirement in 1952. He was formerly with the United States Department of Interior.

'10 Earl D. Hay, M.E., Professor of Mechanical Engineering at Iowa State College in Ames, Iowa, was given the grade of Fellow in the American Society of Mechanical Engineers at a joint meeting of the Marshalltown (Iowa) Engineering Club and the Central Iowa Chapter of the ASME. Professor Hay is pictured receiving the award from Professor H. M. Black, head of the M.E. Department at the college in Ames.

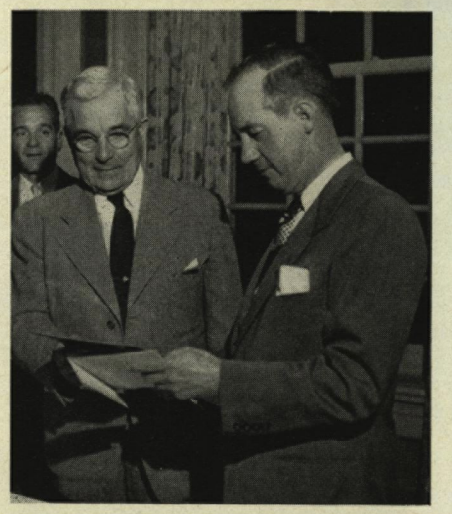
'15 Joseph S. Gillum, C.E., of Philadelphia was recently honored for his outstanding railroad work at a testimonial dinner given him by his railroad friends at the Penn-Sheraton Hotel in Philadelphia. Mr. Gillum only recently became superintendent of the Relief and Pension Departments of the Pennsylvania Railroad after having served many years as superintendent of the Philadelphia Terminal Division of the railroad.

'27 Dr. Warren R. Ferris, E.E., of Washington, D.C., will be honored by the Institute of Radio Engineers at its national convention at the Waldorf-Astoria in New York on March 25, 1953. Dr. Ferris has received the grade of Fellow in the Institute; this grade was effective January 1, 1953.

'32 Mr. Frank P. Butler, C.E., formerly with the American Consulate at Istanbul, Turkey, is now First Secretary of the Embassy of the United States of America at the American Embassy in Vienna, Austria.

'32 P. Arvard Smith, Ch.E., of Houston, Texas, died November 20, 1952. Mr. Smith, a Rose honor graduate, had served for some years with the Carbide and Carbon Company. His position at the time of his death was Department Head, Chemicals Division, Texas City, Texas.

'34 Mr. H. Loren Thompson, C.E., was elected president of the Oregon section of the American Society of Civil Engineers. Mr. Thompson is a partner in Stevens and Thompson, consulting engineers, at Portland, Oregon.



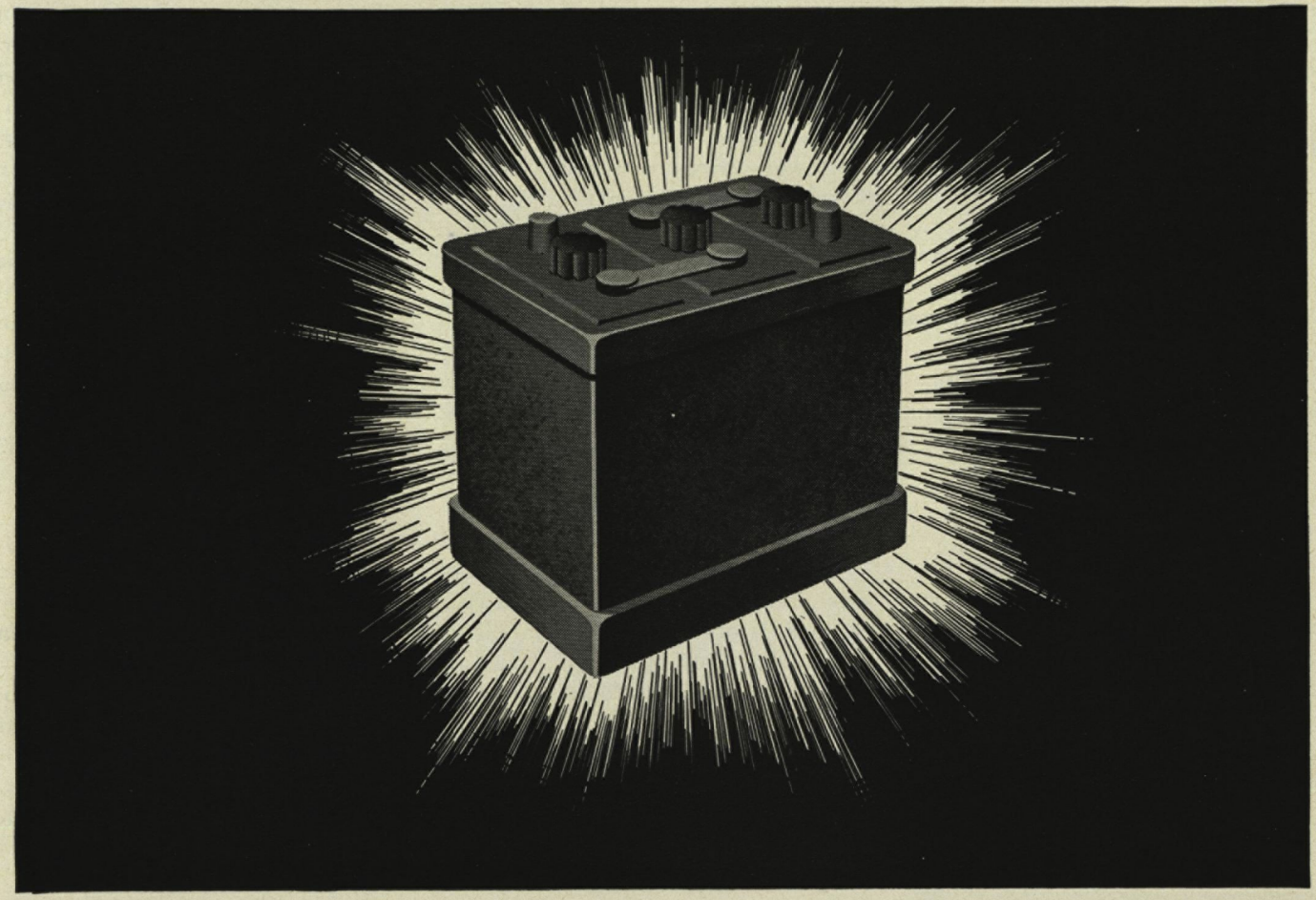
Earl D. Hay Receives ASME Award From Prof. H. M. Black

'35 P. Byrne Terhorst of York, Pa., M.E., has recently been promoted to the position of Works Manager at the Grantley Works of the York Corporation, manufacturers of room air conditioners.

'40 Mr. Richard A. Mullins, Ch.E., has been appointed co-chairman of the Program Committee of the Coal Division of the American Institute of Mining and Metallurgical Engineers for the coming year. He is also a Director of the Indiana Coal Preparation and Utilization Society. Mr. Mullins is now chief chemist for Ayrshire Collieries Corporation.

Dec. '47 Lt. John W. Price, M.E., is back in the states from oversea's duty with the Air Force. He plans to leave in about a month for a period of duty in Africa and then final separation from the Air Force. Lt. Price is with the 52nd Bomb Squadron and is now stationed at the Lake Charles Air Force Base in Louisiana.

July '49 William Smock, E.E., Junior Enginer with the Allison Division of the General Motors Corporation, has been recalled to active duty as a Captain in the Marine Air Corps.



PICKLED AMPERES...

That was the term used to describe the first storage batteries. For a score of years they were considered laboratory playthings, for they were crude, undependable, and required months or years to charge.

Their counterpart today is a reliable source of electrical energy . . . to start cars . . . to operate submarines, mine cars, materials handling equipment . . . and to perform over 200 other regular and emergency functions on land, sea and in the air.

CELLS—BRAIN AND BATTERY...

Storage batteries were conceived in France and England . . . but grew up in America. For Americans foresaw their commercial usefulness. Scientists performed experiment after experiment—thousands of them—to find the elements and chemicals with the best electro-chemical behavior . . . investors helped get production started . . . industry developed new applications . . . and today they build batteries by the millions.

AMERICA WORKS THAT WAY...

Each spark of genius electrifies dreamers, designers, engineers, executives, producers and purchasers. And the power behind our progress is America's all-seeing, all-hearing and reporting Inter-Communications System.

THE AMERICAN INTER-COM SYSTEM...

Complete communication is the function, the unique contribution of the American business press . . . a great group of specially edited magazines devoted to the specialized work areas of men who want to manage better, design better, manufacture better, research better, sell better, buy better.

COMMUNICATION IS OUR BUSINESS...

The McGraw-Hill publications are a part of this American Inter-Communications System.

As publishers, we know the consuming insistence of editors on analyzing, interpreting and reporting worthwhile ideas.

We know that businessmen, in order to keep abreast of their jobs, subscribe to — pay for — McGraw-Hill magazines edited for their specific business interests . . . for the editorial pages tell "how" and the advertising pages tell "with what."

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330 WEST 42nd STREET, NEW YORK 36, N. Y.

HEADQUARTERS FOR BUSINESS INFORMATION

The Chemical Industry's

BIG BABY

(*Concluded from page* 9)

We said that no one knows just how big the industry is, but here are a few things that we do know about its size.

In 1951 petrochemistry supplied well over 50% of all our organic chemicals. Today the percentage is larger.

Petrochemicals manufactured in 1950 totaled almost 14 billion pounds which doesn't sound like too much until you consider that this was more than double the 1949 total. No wonder statistics can't keep up! Incidentally, tremendous as this production was, it required less than one-half of one percent by weight of the nation's oil and natural gas production.

About 70% of our industrial alcohols are synthetic.

Today more than half a million compounds could be synthesized from petroleum if only we had uses for all of them. As it is, 40% of the sales of the major chemical companies in 1949 were of products which had not been developed prior to 1935.

One of the three words mentioned at the beginning of this article, polymerization, describes a billion dollar industry that was built out of nothing in World War II, the synthetic rubber industry.

About 20% of all detergents manufactured in 1950 were synthetic. The percentage is larger today.

Perhaps now, you have some idea of the size of petrochemistry today.

Petrochemistry is probably one of our most concentrated industries, since, 85% of all petrochemical plants lay within 200 miles of Houston, Texas, on the Gulf Coast.

A petrochemical plant sitting on the flat Texas coastal plain looks much like an oil refinery. It has the same towers and cylinderical tanks, the same maze of pipes that entwine all the working mechanism into one neat package, the same clipped lawns and trim parking spaces between plant and road. Moreover, as in a refinery, its processes go on unseen; they are managed from control boards by men who rarely see their raw materials or products.

But there is one key difference. The oilman deals in materials by the tens of thousands of barrels a day, whereas the petrochemist is satisfied with an output of a few tons per day. He makes his business pay by a method which you may have noted as you read. He "upgrades"; that is, he uses low cost raw materials to make a fairly limited quantity of a rather expensive product. A short return glance at the examples previously stated will drive this fact home.

There you have it, a brief look at petrochemistry, a science whose products are strange new molecules. Still ahead lies the field that plays with the atoms themselves, nuclear chemistry.

Hughes cooperative plan for

MASTER OF SCIENCE DEGREES

Purpose **TO ASSIST** outstanding graduates in obtaining their Master of Science Degrees while employed in industry and making significant contributions to important military work.

Eligibility June 1953 college graduates and members of the armed services being honorably discharged prior to September, 1953, holding degrees in the following fields:

ELECTRICAL ENGINEERING
PHYSICS
MECHANICAL ENGINEERING

Those chosen to participate in this plan will be from the upper portion of their graduating classes and will have evidenced outstanding ability. They must also have displayed some degree of creative ability and possess personality traits enabling them to work well with others.

Citizenship Applicants must be United States citizens, and awards will be contingent upon obtaining appropriate security clearance, as work at the Hughes Research and Development Laboratories may be related to National Defense projects.

Universities Candidates for Master of Science Degrees must meet the entrance requirements for advanced study at the University of California at Los Angeles or the University of Southern California.

Program Under this Cooperative Plan, commencing June 1953, participants will follow this schedule of employment at Hughes:

FULL TIME—from June, 1953 to Sept., 1953.
HALF TIME—from Sept., 1953 to June, 1954.
FULL TIME—from June, 1954 to Sept., 1954.
HALF TIME—from Sept., 1954 to June, 1955.

Recipients will earn five-eighths of a normal salary each year and attend a university half time during regular sessions working on their Master's Degree.

Salaries The salary will be commensurate with the individual's ability and experience, and will reflect the average in the electronics industry. Salary growth will be on the same basis as for full-time members of the engineering staff. In addition, the individuals will be eligible for health, accident, and life insurance benefits, as well as other benefits accruing to full-time members.

Travel and Moving Expenses For those residing outside of the Southern California area, actual travel and moving expenses will be allowed up to ten per cent of the full starting annual salary.

Sponsorship Tuition, admission fee, and required books at either the University of California at Los Angeles or the University of Southern California, covering the required number of units necessary to obtain a Master's Degree, will be provided by Hughes Research and Development Laboratories.

Number of Awards Approximately one hundred Cooperative Awards are made each year, if sufficient qualified candidates present themselves.

Selection of Candidates Candidates will be selected by the Committee for Graduate Study of the Hughes Research and Development Laboratories.

Application Procedure Application forms should be obtained prior to February 15, 1953. Completed applications accompanied by up-to-date grade transcripts must be returned not later than February 28, 1953. Selections will be made during the month of March.

Address correspondence to

COMMITTEE FOR GRADUATE STUDY

HUGHES
RESEARCH
AND DEVELOPMENT
LABORATORIES

Culver City, Los Angeles County, California

Palomar's

GIANT EYE

(*Concluded from page* 11)

the spectra of distant nebulae or faint stars.

With the use of this equipment along with other instruments too numerous to mention, the great mirror will be able to not only catch the light of bodies more than a billion light years away, but will be able to calculate the temperatures, the chemical composition, and the relative speed at which they are traveling.

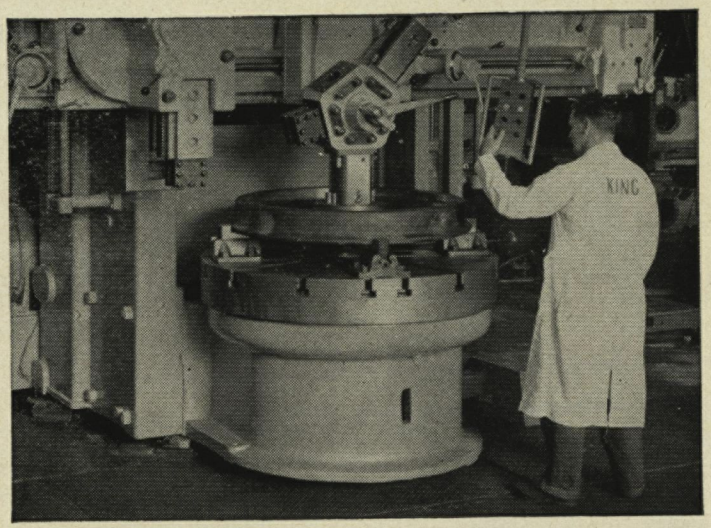
The principle task ahead for the astronomers at Palomar will be to either prove or disprove the theory that the universe is expanding at a terrific rate of speed from some unknown origin.

To do all of this work, the astronomers have only ten to twenty nights a year during which the skies are suitable for viewing with the 200-inch telescope. At other times, weather conditions will make the opening of the observatory dome useless, for the telescope can be operated at its maximum efficiency at just certain times.

The respects in which the Hale telescope is expected to surpass all others are—resolving power in which it is hoped there will be produced further evidence concerning the canals of Mars or the atmosphere of Venus. Secondly is dispersion, or the gathering of more information about the abundance of the elements in the universe. The third is space penetration. This will be used to further the knowledge of man as to the distribution of the galaxies which are the key to the theory of the expanding universe.

The vastness of the set-up at Palomar, whether it is studying the stars or recording and mapping the heavens, is covered only lightly here, but the whole of the importance of the work done at Palomar in relation to man and his future can never be estimated in words alone.

Another page for **YOUR BEARING NOTEBOOK**

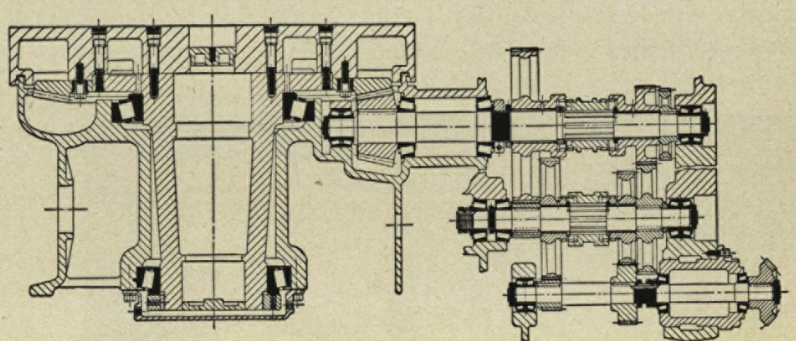


How to keep a high speed boring mill accurate

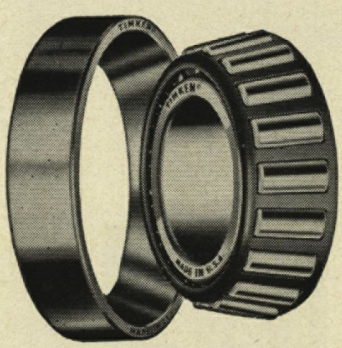
To insure table accuracy in high speed boring mills, spindle vibration must be eliminated. That's why designers mount the table spindles on Timken® precision tapered roller bearings. They hold spindles in positive alignment, eliminate vibration. Line contact between rollers and races of Timken bearings provides extra load-carrying capacity. The true rolling motion and incredibly smooth surface finish of Timken bearings practically eliminate friction and wear within the bearing itself.

How spindle and drive shafts are mounted on TIMKEN® bearings

The drive of a high speed boring mill is mounted on single row type TS, and two row type TNA bearings. Input, intermediate and bevel pinion shafts are mounted on two type TS bearings on one end, and a two row type TNA bearing free to float on the opposite end. Single row type TS bearings are indirectly mounted on the main table vertical spindle.



TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



Want to learn more about bearings?

Some of the engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'll be glad to help. Clip this page for future reference, and for a copy of the 270-page General Information Manual on Timken bearings, write today to The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⦶ AND THRUST ⊸⦶⊸ LOADS OR ANY COMBINATION ✳

Research and Development

(*Continued from page* 20)

arrangement a short-circuit tends to open the contact.

In the new type WSB no-load tap changer the stationary contacts are vertical blunt-nose pins about 1/4 inch in diameter. The moving contacts consist of two short metal bars supported from the tap-changer mechanism by flat, spring-steel straps. When the geneva gear operates to establish a new tap contact these bars are lowered vertically around the stationary pins. The bars are shaped to fit snugly around the pins. The conducting paths are arranged so that current through the contact causes the bars, by interaction of the fields, to grip the pins tighter. Thus electrical forces are made to do the work of establishing a firm contact, and a contact is improved rather than blown open by a short circuit. With this system the spring pressure need be enough only to insure the desirable contact-wiping action with each operation. Switch operation thereby requires little physical effort. Short-circuit tests prove that this construction can withstand a current of 80,000 amperes without blowing apart or burning contact. This is probably 4 or 5 times more than is possible with conventional constructions. The 100-ampere and 200-ampere (continuous rating) models have reached the production stage. Higher ratings are expected to follow.

The judicious use of small crepe paper shields has resulted in shortening the shafts of no-load tap changers on high-voltage transformers by nearly half. For some time these shields have been used on high voltage tap changers which are somewhat like the arcing rings seen on arresters. These distribute the electrical stress over the tap-changer shaft so that its strength to impulse voltages is greatly enhanced. Now, in addition, the metal rings are wrapped in the insulating paper, which greatly reduces the clearances needed to withstand the high 60-cycle and surge voltages. Thus, for example, th Micarta shaft on a 220-kv ta changer that was 40 inches long nee be only 20 inches long.

"Canned" Motors for Pumping "Hot" Water in Atom Sub Engin

Motors driving hot-water circu lating pumps for a nuclear reacto are, literally, canned. The squirre cage rotor is contained in a shrink fit jacket of steel. It turns within stator that likewise is fully enclose in stainless steel. In this type of motor, the term "air gap" cannot b used as it is a combination of wate and two layers of metal. Both th stator and the rotor are encased i stainless steel, and the space betwee is filled with flowing hot water—th same fluid that is being pumpe through the reactor circuit.

As with most of the component of the reactor circuit, leakage mus be small. Hence the motors cannc drive the pumps through seals. Th rotor must be contained within th

(*Concluded on page* 34)

Austin Bush, Rensselaer, '50, Helps Develop New Pump

AUSTIN BUSH, inspecting stuffing box assembly on boiler feed pump.

Reports interesting project engineering assignments at Worthington

"Despite its size as the leading manufacturer in its field," says Austin Bush, "I have found Worthington pays considerable attention to the interests of the individual. The company's excellent training program consists of several months of working with the various types of equipment manufactured, augmented by technical lectures, and talks on the organization of the corporation.

"Following this training, I was given an opportunity to choose the department in which I wanted to work—engineering, sales, or manufacturing. My choice was the engineering department where I have already been assigned to several interesting projects.

"In addition to the training program, the members of our engineering department hold monthly seminars at which engineering topics of general interest are discussed.

"Opportunities for advancement are good, and pleasant associates make Worthington a fine place to work."

When you're thinking of a good job, think *high*—think *Worthington.*

FOR ADDITIONAL INFORMATION, see your College Placement Bureau or write to the Personnel and Training Department, Worthington Corporation, Harrison, New Jersey.

WORTHINGTON

The Sign of Value Around the World

2.54X

Fraternity Notes

By John Gregory, George Ross, Robert Dedert, and Jack Niemi

ATO

Things were rather quiet around 63 Gilbert during the month of January, for this month not only brought in the New Year but also brought thoughts and some skepticism concerning the final exams. The only meeting of the chapter was held on Monday night, January 5, in preparation for Help Week and formal initiation for the newest pledges on the following Sunday. The next two meetings were concelled in preparation for finals and the between-terms vacation meant no meeting on the 26th.

The house began buzzing, however, after examinations, for February brought rush weekend and State Day. This year the meeting of the seven chapters of Province 17 will be held at Turkey Run State Park on Saturday, February 21. All Alpha Taus look forward to this annual gathering and this year's meeting should prove as interesting and memorable as those past.

The new term brought the appointment of new staff heads for the Technic. The Taus serving for the next year are Bob Miller, assistant editor, Don Powers, business manager, Ralph Llewellyn, head of the contributing staff, Bob Stewart, head of the advertsing staff, and Frank Rendaci, head of the photography staff.

Matty "the Whip" Matthews has been showing quite a bit of prowness on the hardwood recently, especially during the Harris Teachers College game. Jim "fast-broke" for a grand total of 17 points. One of his most loyal boosters is a young lady by the initials of D. L. M. who never misses a game.

Nothing new for the obituary column — ATO pins are getting rather scarce it seems.

Sigma Nu

Beta Upsilon of Sigma Nn formally announces the purchase of a new residence, a red brick affair with a spacious porch that completely fronts the house including commander Center, very close to St. Anthony Hospital. Inside are 18 comfortable size rooms not including 3½ baths, the living room is of such size that the chapter is hopeful of holding small dances in the house proper; it can be assured that some dances will be held on the front porch when the weather permits. There is provided on the first floor a separate room which has been set aside for a combination library and study.

At present there are 21 living in the house including commandar Robert Ray who officially resides in town but just couldn't miss out on the general elated feeling that living in the new house gives.

The chapter didn't slow up a bit before moving; a good example was the dinner party attended by brothers who were in town between semesters and their dates. After a memorable meal served up by "Mom," everyone scattered to dress for the Crystal Ball which was held in the Mayflower Room of the Terre Haute House.

More pin and engagement news John Crisp pinned Miss Marjorie A of Terre Haute, Phillip Kirk has hi pin out to Miss Phyllis Wolf, an Rick Werking did likewise to Mis Jayne Martin. Both Miss Wolf, an Miss Martin are from Indianapolis Bob Mogle, just recently pinned gave up the struggle and takes th title of "engaged." His intended i Miss Georgia Graves of Indianapolis

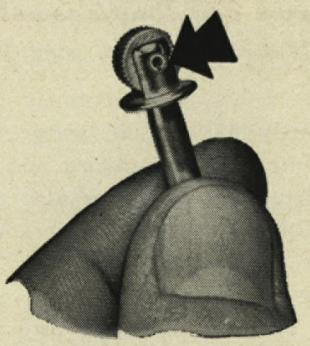
Theta Xi

Kappa chapter has really beer humming lately due to the newly formed "Terror Trio" of Bros. Mook Jones, and Ulbrich who have beer supplying the brothers with some sweet(?) refrains. The brothers wil agree when I say we especially like their rendition of that new pop tune "Water Can't Quench the Fire o Love."

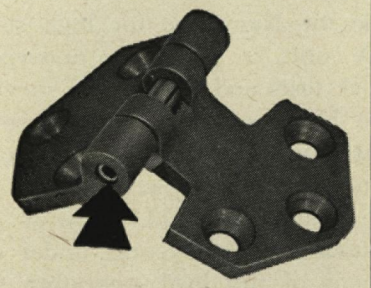
Kappa recently presented its coveted scholastic key to the man who had the highest rise in his accumalative for school year 51-52. This award went to none other than Robert "Stink" Steinhauser. Congratulations Bro. Steinhauser.

We would also like to congratulate Bro. Gene Hailstone and wife Suzy on the new addition to Hailstone Enterprises. Gene, who graduated in June '51, and Suzy became the proud parents of Amy Beth who weighed in at 6 lbs. and 12 oz on the 15th of December, 52.

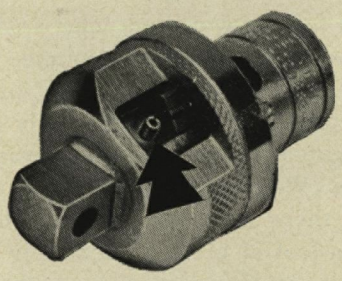
Theta Xi recently pledged Frankie Przybylski, therefore we think congratulations are also in order to Frank. Congrats Frankie.



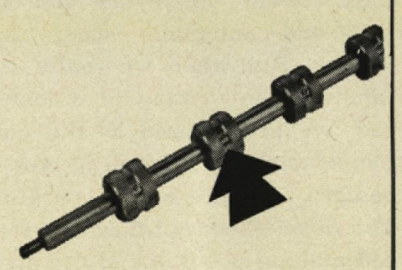
Replacing a rivet



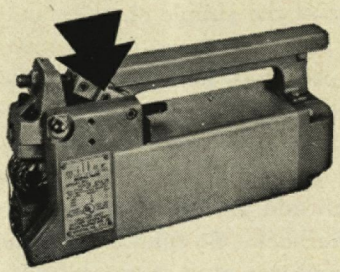
. . . a hinge pin



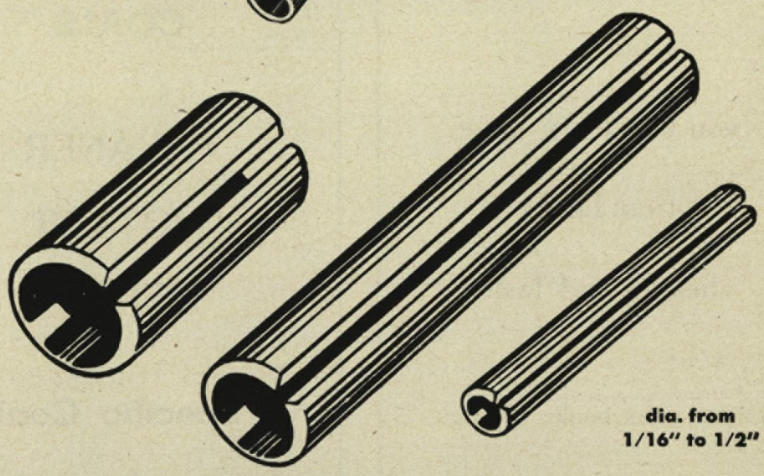
. . . a stop pin



. . . a set screw



. . . a bolt and nut



dia. from 1/16" to 1/2"

. . . a modern fastener that saves time and money on thousands of applications

Rollpin is a hollow, split, cylindrically formed pin with chamfered ends. It is simply driven into holes drilled to normal production tolerances. Because Rollpin is slightly larger than standard sized holes, it compresses as inserted. It is self-locking—and vibration-proof—because of the constant pressure it exerts against hole walls. Its shear strength exceeds that of a cold rolled pin of the same diameter. Rollpin is readily removed with a drift or pin punch—and can be reused.

Because of its versatility—and the production economies it makes possible—Rollpin is finding wide usage in almost every phase of manufacturing activity. Write for design information on the Rollpin. It will enable you to cut costs for many applications where use of rivets, set screws, dowels, and straight, serrated or cotter type pins create installation or performance problems.

ELASTIC STOP NUT CORPORATION OF AMERICA

2330 Vauxhall Road, Union, New Jersey

Elastic Stop Nuts with the famous red collar are another ESNA product

Research and Development

(*Concluded from page* 30)

fluid circuit—and obviously is continuously exposed to water that is hot both in temperature and radioactivity. The bearings also are inside the stator and are lubricated by water.

The motors are built in several sizes. As if these many unusual requirements were not enough, the whole packaged unit — motor and pump built integral with it — must pass the Navy test for high shock. One unit is presently undergoing shock tests and has to date survived five blows of relatively severe intensity without any visible or operational damage. A smaller unit has been running for 13,000 hours continuously (1-1/2 years) under conditions of full load, operating temperature, and pressure.

The Machine Age

In today's world we take mechanization as a matter of course. Each new labor saving device is quickly accepted and just as quickly it is relegated to the "taken for granted" class. We no longer stop to think that there are other ways of obtaining a loaf of bread than simply buying it at the corner grocery. The baker, in turn, takes for granted the machines which knead the dough, endless chain conveyors for the ovens, and automatic slicers and wrappers. But when we really stop to analyze the making of a loaf of bread, we are amazed at the complicated machinery which is now so necessary to a once simple operation.

The development of machinery for bread making is but one of the many processes which is treated in *Mechanization Takes Command,* by Siegfried Giedion. From the development of the simple chair to assembly line production, the mechanization of the processes are discussed and pictured. Line drawings, photographs and reproductions of paintings are among the kinds of illustrations which add greatly to the importance of the book. So take a quick look at the pictures even if you haven't time to read the whole book.

THE DU PONT DIGEST

JOB WITH A FUTURE—

Supervising Production

Varied experiences in a Du Pont chemical plant fit young engineers for higher responsibility

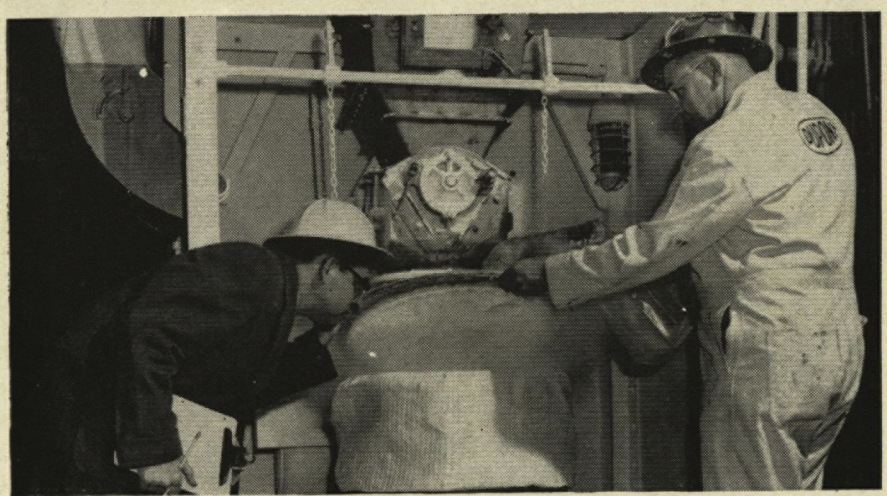
As was pointed out in the last issue of the *Digest*, Du Pont's many product lines afford men interested in production supervision experience in a wide variety of operations.

For a better idea of what the work involves, let's consider a specific case—the production of "Mycoban" sodium and calcium propionates, inhibitors used by bakeries to extend the mold-free life of bread and other baked goods.

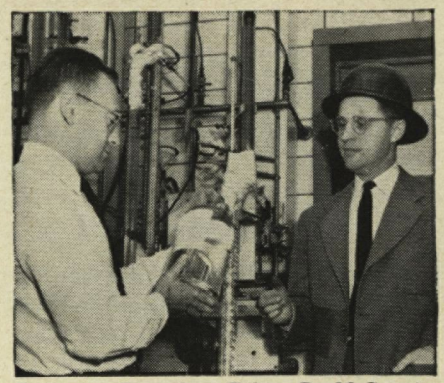
Many of the problems encountered in the manufacture of "Mycoban" are similar to those arising in the manufacture of any Du Pont chemical. There is the same continuing effort to improve quality, while cutting costs through the better use of equipment, instrument controls and raw materials.

The supervisor works hand in hand with the plant technical section toward these goals. He also keeps himself informed on technological and economic trends affecting production and sales, finds explanations for out-of-line costs, and prepares plans and estimates for increasing production.

Such work obviously calls for a sound technical background. In addition, however, considerable administrative ability is needed. A supervisor must be able to *supervise*. His duties include keeping people under him informed about long-range changes in company policy and assuming responsibility for their safety and morale.



Process Control Engineer *W. L. Morgan (at left), B.S. in Ch., West Virginia Wesleyan '37, observes packing characteristics of "Mycoban" powder as it comes from the loading hopper.*



Production Supervisor *Robert B. McCue (at right), B.S. in Ch. E., West Virginia '38, and plant laboratory shift-leader J. P. Quarles, B.S. in Ch. E., Lehigh '38, discuss analysis of a product sample.*

The unusual problems encountered in "Mycoban" production are largely due to the seasonal nature of its sales. Its greatest use is in the hot, humid months, or from late spring to early fall. For this reason:

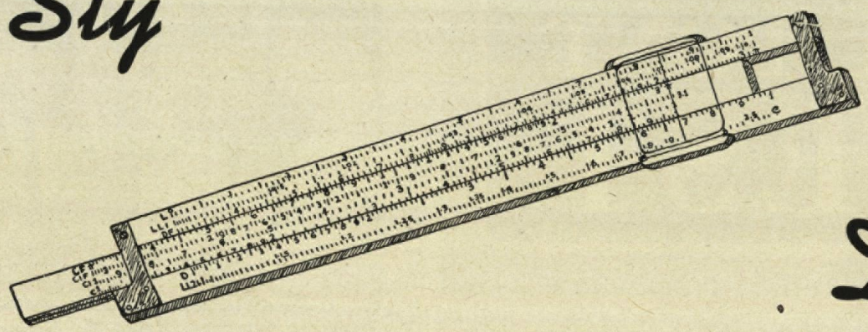
1. Production and warehouse inventories of "Mycoban" must be carefully balanced against sales forecasts. The supervisor gathers necessary background information for this operation.

2. Production needs, including manpower, equipment and materials, must likewise be planned to meet sales forecasts.

3. Maintenance, including a yearly hydrostatic test of the plant, must be scheduled with the plant maintenance supervisor for the minimum interference with peak-season production. Emergency maintenance must be kept down by carefully planned preventive maintenance.

As you can see, production supervisors have a broad field of activity at Du Pont. The experience gained in this job will prepare an ambitious man for advancement to positions of still higher responsibility.

Sly



Droolings

Stolen by Dick Bosshardt, m.e., soph.

Jack and Jill went up the hill.
Upon a moonlight ride.
When Jack came back, one eye was black.
His pal, you see, had lied.

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Woman's best asset is man's imagination.

* * * * *

Lipstick is merely something to give new color to an old pastime.

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"Daughter, what are you and that young man doing out on the porch?"

"We're petting, Mother."

"That's nice, children, don't fight."

* * * * *

I studied abroad for a year, and then I married her.

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Dedicated to the Junior class at Union Hospital.

Student Nurse: "Every time I bend over to listen to his heart his pulse rate goes up alarmingly. What should I do?"

Instructor: "Button your collar."

* * * * *

"What makes your tongue so black?"

"I dropped a bottle on a freshly tarred road."

* * * * *

If it hangs where its supposed to, a gal's locket is bound to be in the groove.

* * * * *

Mary: "Boy, you have to hand it to Bill when it comes to petting."

Betty: "Why, is he lazy?"

Professor: "Well, what did you think of the course?"

Student: "I thought it was very well covered. Everything that wasn't covered during the semester was covered on the final."

* * * * *

"Did you get home from the party all right last night?"

"Fine, thanks, except that as I was turning into my driveway some idiot stepped on my fingers."

He—"Would you think it improper if I kissed your hand?"

She—"Not improper, just out of place."

Customer: "Have you a boo called 'Man, the Master of Wom an'?"

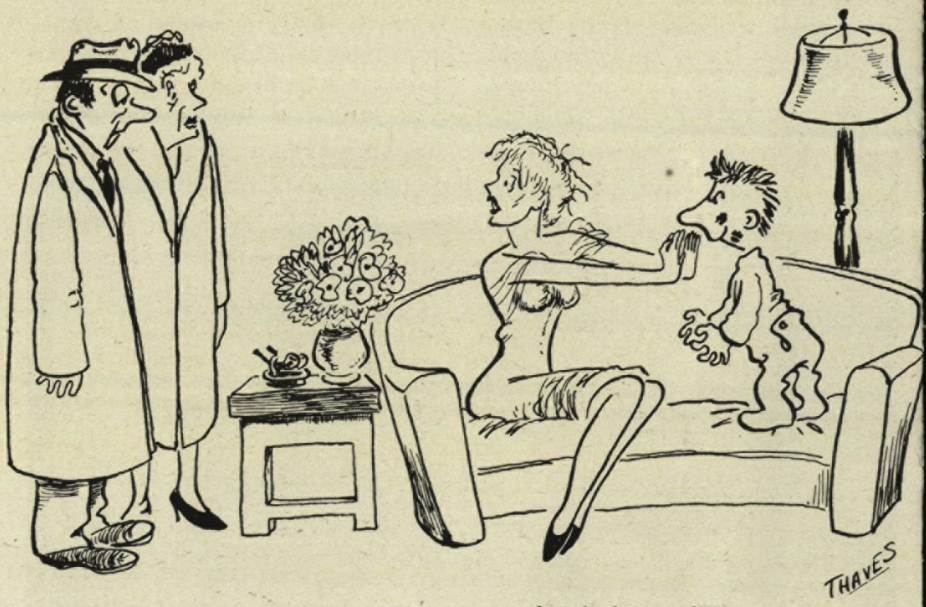
Salesgirl: "The fiction counter i to your left, sir."

* * * * *

Sven got into the mine elevato chuckling out loud.

"What's the joke, Sven?" aske the elevator operator.

"Ay ban have a good joke o Ole," he replied. "Ay just find ou that Ole pay my wife five dollar to kiss her and here I do it fo not'ing".



"Why no, he's been a perfect little angel!"

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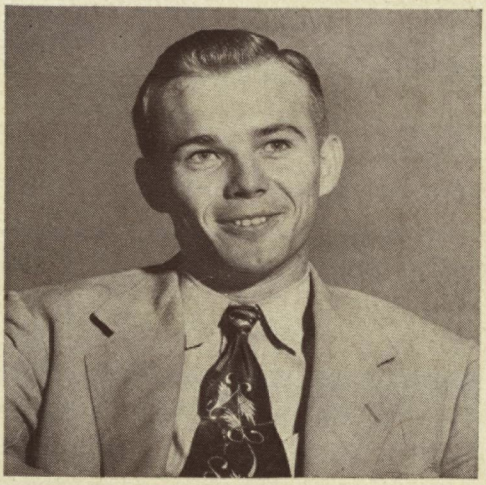
MY QUESTION TO THE G-E STUDENT INFORMATION PANEL:



"What educational training opportunities are available to engineers in General Electric?"

. . . JAMES H. ROBBINS, University of Florida, 1953

The answer to Mr. Robbins' question, presented at a student information meeting held in July, 1952 between G-E personnel and representative college students, is printed below. If you have a question you would like answered, or seek further information about General Electric, mail your request to College Editor, Dept. 221–6, General Electric Co., Schenectady, N. Y.

M. M. BORING, *Engineering Services Division* . . . In General Electric the engineer has his choice of engaging in either Company education programs or in graduate study in nearby colleges and universities.

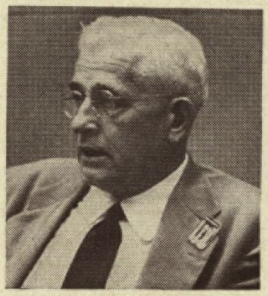
The Company programs are based on material directed toward better fitting the engineer for a career with the Company. He will gain first-hand knowledge of industry, come in contact with many different products and types of work, and associate with top-flight engineers.

General Electric actively encourages college graduate study, and when this study applies to the individual's work, on approval by his departmental manager, provisions are made for refunds of one-half tuition costs upon satisfactory completion of courses.

The technical education programs in G.E. may be divided into two main categories: the advanced technical programs, where carefully selected students (any engineer may apply) are given intensive training; and the general and specialized technical courses, available to all Company engineers.

The objective of the advanced technical programs—Creative Engineering, Advanced Engineering, and Process Technology—is to impart an understanding of fundamental scientific principles and their application to particular problems, as well as to encourage a basic approach to these problems and promote confidence in the engineer's own ability.

The Creative Engineering Program is directed toward developing creative and inventive abilities, and a logical approach to design problems by definition, search, selection, and evaluation.



Organized to develop top-flight engineers, the Advanced Engineering Program provides an opportunity to study fundamental physical principles and advanced mathematical methods in the areas of electrical and mechanical engineering.

The Process Technology Program, concerned with chemical, chemical engineering, and metallurgical fields, acquaints the engineer with laboratory and engineering groups, with activities in many locations, and with various product businesses of the Company.

The category that includes the general courses is designed to acquaint engineers with the engineering aspects of marketing, manufacturing, and application engineering as well as providing less intensive courses on fundamental principles. The specialized technical courses provide intensive study for engineers permanently assigned to operating departments in such fields as servomechanics, heat transfer, and magnetic design.

In addition, educational opportunities are offered engineers by our Manufacturing, Marketing, Employee and Plant Community Relations, and other divisions.

Besides having the opportunity for educational development, the engineer in General Electric is given a good job with plenty of responsibility, sound training for a lifetime career, opportunities for careers in widely varied phases of science and engineering, a good place in which to work, and a place in which to lead a well-rounded life.

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